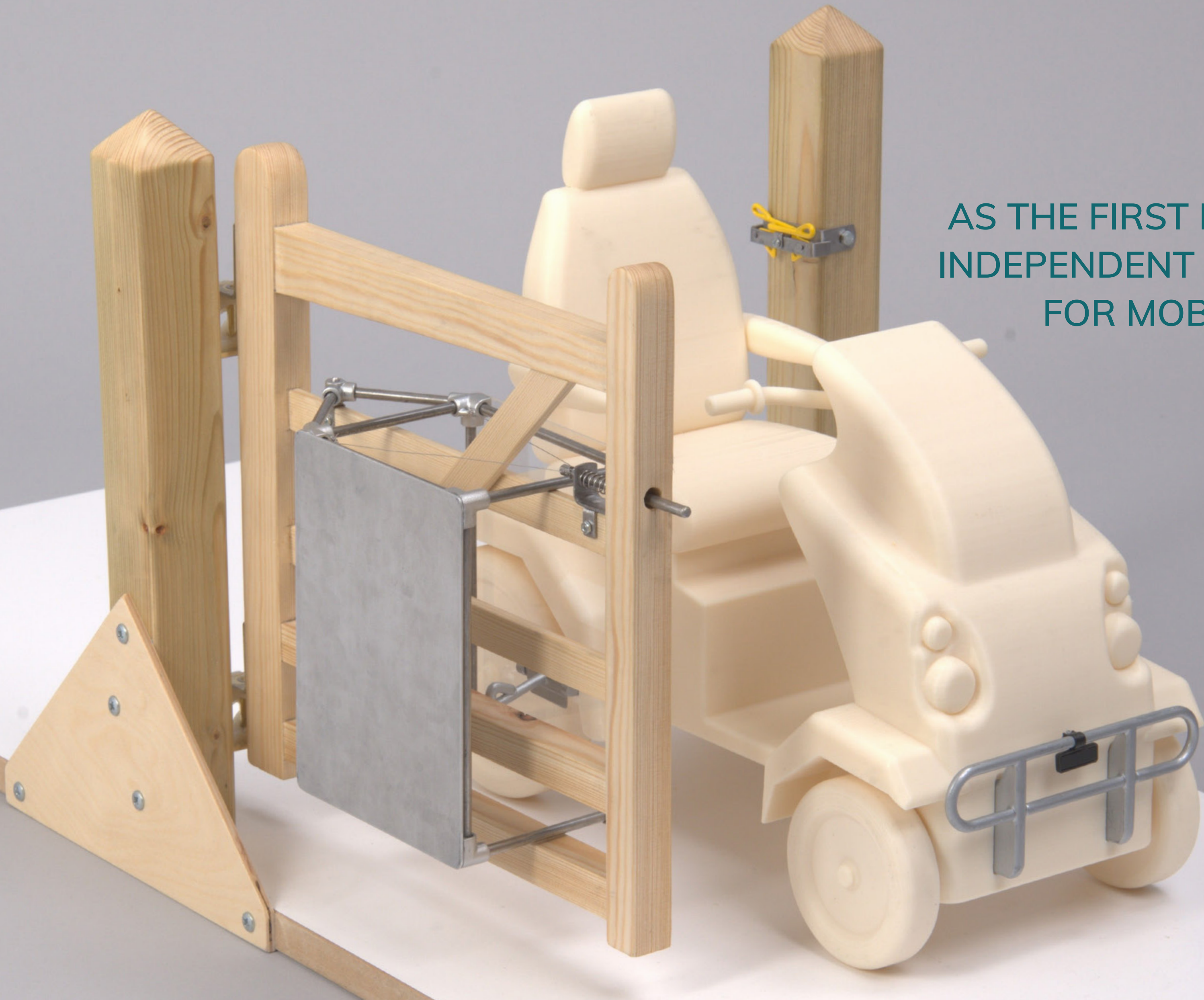
FREE STILE

BREAKING THROUGH ACCESSIBILITY BARRIERS IN THE COUNTRYSIDE



AS THE FIRST FOOTPATH GATE WITH
INDEPENDENT & HAND-FREE ACCESS
FOR MOBILITY SCOOTER USERS

BRUNEL UNIVERSITY LONDON
PRODUCT DESIGN BSC (HONS)
MAJOR PROJECT REPORT
LAUREN PAYNE
2011759

ACKNOWLEDGEMENTS

I would like to express my gratitude to all those who helped me along the way with this project. First, I would like to thank Shail Patel for organising this project and the Accessible Gates Workshops and for his support throughout the project.

Thank you to everyone in the Accessible Gates Workshop for their time, knowledge, feedback and continual support. I would like to thank Val and the whole team at the COAT centre for providing great insights, welcoming me into the team and providing materials. Thank you to Martin, Jed, and the Centrewire team for providing critical industry insight and gate components and working with me on this project. Thanks to Tom Bindoff for your insight and interest in this project. Thank you to the farmers and land rangers who partook in my semi-structured interviews about their experience.

Thanks to my supervisors, Liang Li and Arthi Manohor, for supporting and guiding me through this project. Thanks to the workshop technicians, especially James and Will for really taking the time to help me develop my practical skills throughout this project. Thank you to the Made in Brunel team for accommodating my oversized project and to everyone who has helped me carry parts back and forth.

Thanks to the disabled ramblers community for the overwhelmingly positive response to this project and the help they provided along the way. Thank you to all the individuals who publicly share their experiences online, helping to raise awareness of the inaccessibility they face. With special thanks to all of those within this group who participated in semi-structured interviews and gave feedback and evaluations of my concepts.

Lastly, I would like to thank my family, housemates, friends, everyone in the Design Studios and Simba the dog for supporting me through this journey. I couldn’t have done it without you guys.

EXECUTIVE SUMMARY

This major project report explores how the UK countryside and rights of way could be made more accessible for wheeled mobility aid users by designing and developing the first hands-free footpath gate that still restricts livestock. This project is a collaboration with the Accessible Gates Workshop. The author believes that it is essential for everyone to have access to the countryside, and this is often not the case. Taking on this project and developing a real working solution will make a substantial difference in reducing the challenges that wheeled mobility users face and that the author is well aware of as an individual with mobility challenges.

It follows a participatory design process, collaborating with key stakeholders through semi-structured interviews and online collaborative workshops to gain valuable insights. Autoethnography was also conducted. Outcomes from all the interviews and research highlighted that all current solutions are insufficient and that a low-tech, easy-to-maintain, affordable solution was the way forward. This was achieved using push plates and permanent magnets. This gate mechanism fulfils the needs of the wheeled mobility user to efficiently operate the gate hands-free whilst ensuring that livestock can't get through.

The collaborators, landowners and mobility aid users are very happy with the concept and design, but further work will need to be done to make it a goal that is ready to be fully implemented across the country. Some limitations were the sample size of interviewees and the inability to test with participants in person. The recommendation going forward is that the author and collaborators continue to develop the gate and test it with the user group with the hopes that one day, it could be used across the whole UK.

This document is offered into the public domain for use under the Creative Commons Public Domain licence CC BY-SA 4.04 , in summary: "This license requires that re-users give credit to the creator. It allows re-users to distribute, remix, adapt, and build upon the material in any medium or format, even for commercial purposes. If others remix, adapt, or build upon the material, they must license the modified material under identical terms."

CONTENTS

1. INTRODUCTION

1.1 WHAT TO EXPECT 8
1.2 MEET THE TEAM 9
1.3 PROJECT PLANNING 10
1.4 THE PROBLEM 12
1.5 THE BRIEF 13

2. DISCOVER

2.1 BACKGROUND RESEARCH 15
2.2 LITERATURE REVIEW 16
2.3 NEED FOR PHYSICAL BARRIERS 18
2.4 KEY STAKEHOLDERS 19
2.5 ACCESSIBILITY PROGRESS 20
2.6 METHODOLOGY 21
2.7 PRIMARY RESEARCH KEY FINDINGS 22
2.8 USER PERSONAS 24
2.9 MARKET ANALYSIS 26
2.10 INITIAL RESEARCH CONCLUSION 31

3. DEFINE

3.1 REDESIGNING THE BRIEF 34
3.2 INITIAL IDEAS 35
3.3 INDUSTRY REVIEW EVENING 38
3.4 CONCEPT IDEATION 40
3.5 LANDOWNER INTERVIEWS 42
3.6 MAGNET VIABILITY 46
3.7 MATERIALS 47
3.8 ECONOMIC VIABILITY 48

4. DEVELOP

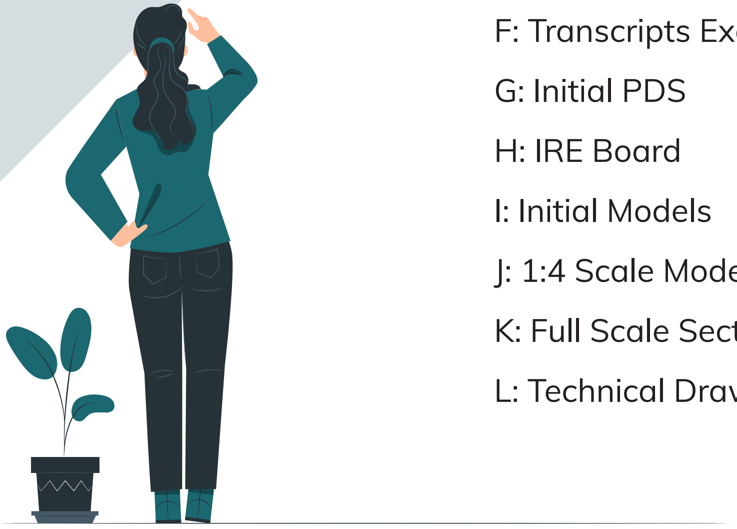
4.1 MECHANISM DEVELOPMENT 50
4.2 PRODUCT DESIGN SPECIFICATION 52
4.3 MAGNET EXPLORATION 54
4.4 CONCEPT DEVELOPMENT 55
4.5 PHYSICAL PROTOTYPING 56
4.6 USER CONCEPT EVALUATION 59
4.7 VEHICLE ATTACHMENT IDEATION 60
4.8 MATERIAL & MANUFACTURING 61
4.9 PROTOTYPE DEVELOPMENT 62
4.10 BLOCKER DEVELOPMENT 66
4.11 MAGNET TESTING 68
4.12 VEHICLE ATTACHMENT DEVELOPMENT 71

5. DELIVER

5.1 FINAL DESIGN 74
5.2 FULL-SCALE TESTING 78
5.3 LIMITATIONS & FUTURE DEVELOPMENTS 79
5.4 EVALUATION AGAINST PDS 80
5.5 COLLABORATOR EVALUATION 82
5.6 CONCLUSION 83

6. BACK MATTER

6.1 REFERENCES 87
6.2 GLOSSARY 93
6.3 APPENDICES 95
  A: Collaborative Brief 95
  B: Ethics Approval 97
  C: Autoethnography 99
  D: Example Questions 101
  E: Consent Forms 102
  F: Transcripts Exerts 106
  G: Initial PDS 107
  H: IRE Board 109
  I: Initial Models 110
  J: 1:4 Scale Modelling 112
  K: Full Scale Sectional 116
  L: Technical Drawings 118



INTRODUCTION

1

1.1 WHAT TO EXPECT

This project aims to develop a design solution that improves the accessibility of the countryside for individuals with mobility challenges. This project specifically focuses on improving the accessibility of footpaths for wheeled mobility aid users through developing an accessible barrier. As someone who spent much of her childhood exploring the countryside, and struggles with her own mobility challenges and inaccessibility in daily life, this project is near and dear to the author's heart.

The objectives of this project are to work closely with individuals with mobility challenges and other key stakeholders to explore their experiences and needs when accessing the countryside with a focus on man-made barriers and to develop, test and prototype an appropriate barrier that can be used by these individuals independently.

This report covers the design process of this project, from the identification of the problem through to the delivery of the solution. It details the research, development and methodology used throughout the design project.

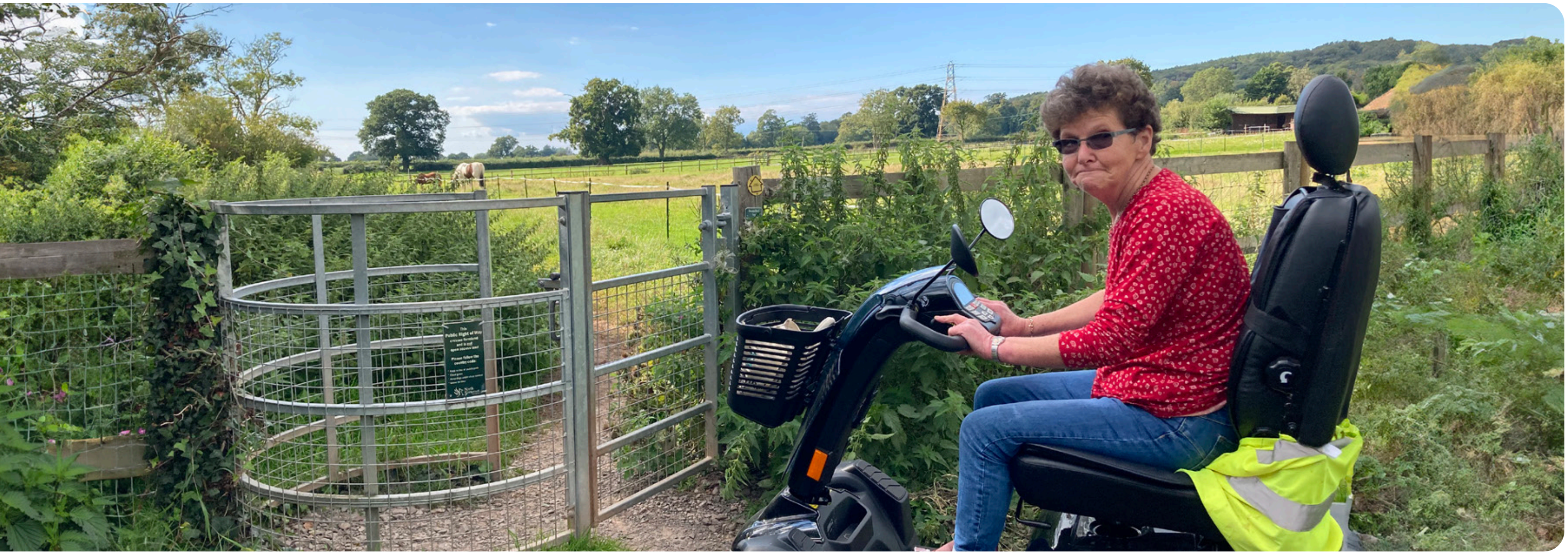


Figure 1. Mobility scooter user blocked by a kissing gate on a footpath

1.2 MEET THE TEAM

This project is in collaboration with the Accessible Gates Workshop, a team of volunteers working towards making the countryside more accessible through design and engineering, led by Shail Patel. The goal of the workshop is to design and develop a new generation of gates or barriers that are more accessible to people with mobility challenges than those currently available (Patel et al., 2024). The team comprises of many individuals: those with mobility challenges, independent accessibility consultants, disability and access ambassadors, designers, engineers, academics, manufacturers, and land managers.

Figure 2. The Disabled Ramblers Logo

The Disabled Ramblers is a charity that works across England and Wales to make the countryside more accessible for individuals with limited mobility, benefiting everyone. Their volunteers organise rambles for mobility scooter users and campaign to raise awareness.

Figure 3. Centrewire Logo

Centrewire is the biggest supplier and manufacturer of specialist Rights of Way Gates in the UK. They make a large variety of gates for both footpaths and bridleways.

Figure 4. Natural England Logo

Natural England is a government-sponsored public body that manages and conserves the natural environment in England, helping to restore our natural world. They are also the government's advisor on the natural environment.

1.3 PROJECT PLANNING

The double diamond design process was used to influence the planning and structure of this project. This allowed for the subject to be discovered and converged to a clearly defined problem that could be developed to deliver a well-considered final concept.

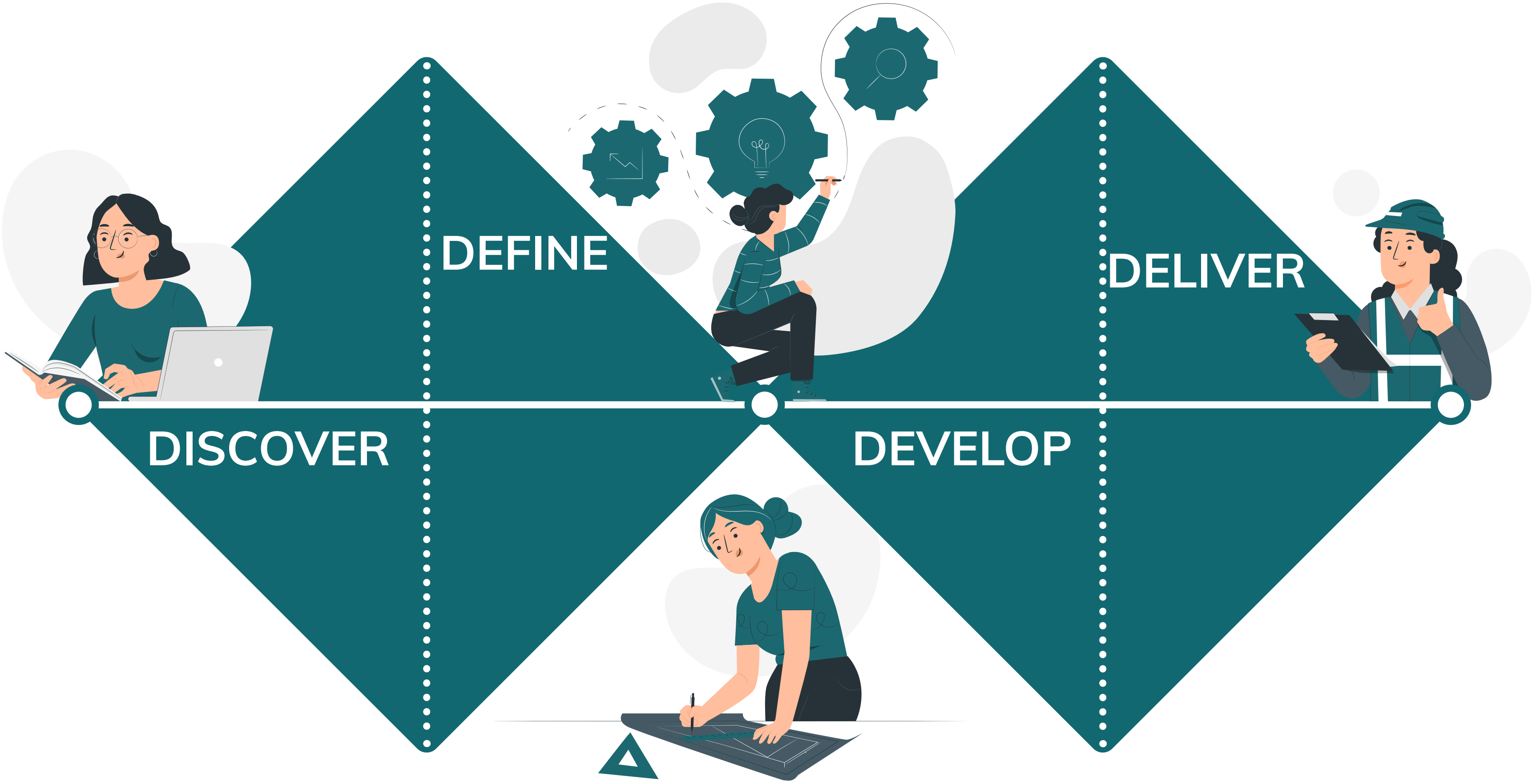
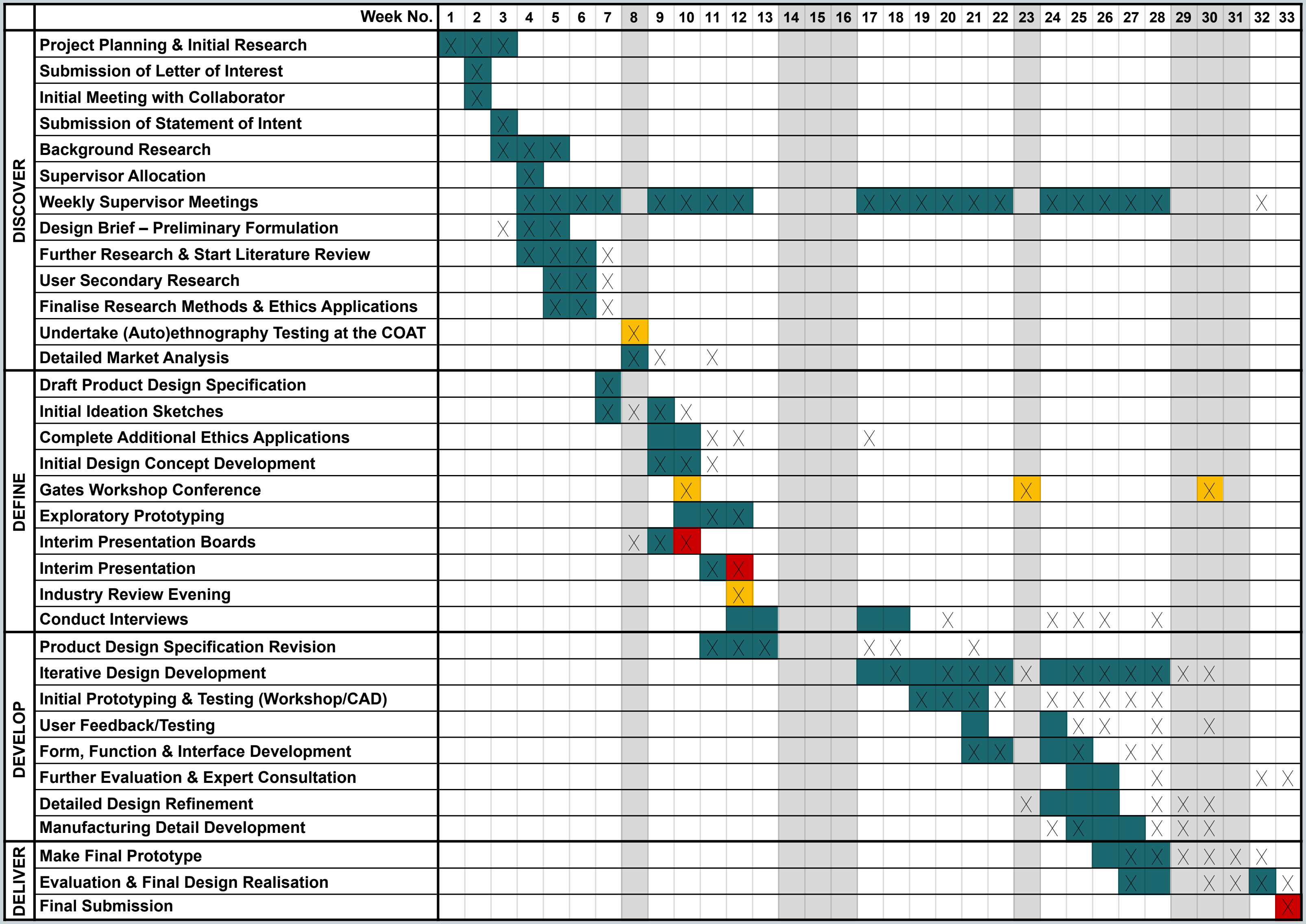


Figure 5. The Double Diamond Model



	Week No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
DISCOVER	Project Planning & Initial Research	🟦X	🟦X	🟦X																														
	Submission of Letter of Interest		🟦X																															
	Initial Meeting with Collaborator		🟦X																															
	Submission of Statement of Intent			🟦X																														
	Background Research			🟦X	🟦X	🟦X																												
	Supervisor Allocation				🟦X																													
	Weekly Supervisor Meetings				🟦X	🟦X	🟦X	🟦X		🟦X	🟦X	🟦X	🟦X					🟦X	🟦X	🟦X	🟦X	🟦X	🟦X		🟦X	🟦X	🟦X	🟦X	🟦X				X	
	Design Brief – Preliminary Formulation			X	🟦X	🟦X																												
	Further Research & Start Literature Review				🟦X	🟦X	🟦X	X																										
	User Secondary Research					🟦X	🟦X	X																										
	Finalise Research Methods & Ethics Applications					🟦X	🟦X	X																										
	Undertake (Auto)ethnography Testing at the COAT								🟨X																									
	Detailed Market Analysis								🟦X	X		X																						
DEFINE	Draft Product Design Specification							🟦X																										
	Initial Ideation Sketches							🟦X	X	🟦X	X																							
	Complete Additional Ethics Applications									🟦	🟦	X	X					X																
	Initial Design Concept Development									🟦X	🟦X	X																						
	Gates Workshop Conference										🟨X													🟨X							🟨X			
	Exploratory Prototyping										🟦	🟦X	🟦X																					
	Interim Presentation Boards								X	🟦X	🟥X																							
	Interim Presentation											🟦X	🟥X																					
	Industry Review Evening												🟨X																					
	Conduct Interviews												🟦	🟦				🟦	🟦		X				X	X	X		X					
DEVELOP	Product Design Specification Revision											🟦X	🟦X	🟦X				X	X			X												
	Iterative Design Development																	🟦	🟦X	🟦	🟦X	🟦X	🟦X	X	🟦	🟦X	🟦X	🟦X	🟦X	X	X			
	Initial Prototyping & Testing (Workshop/CAD)																			🟦X	🟦X	🟦X	X		X	X	X	X	X					
	User Feedback/Testing																					🟦			🟦	X	X		X		X			
	Form, Function & Interface Development																					🟦X	🟦X		🟦	🟦X		X	X					
	Further Evaluation & Expert Consultation																									🟦	🟦		X				X	X
	Detailed Design Refinement																							X	🟦	🟦	🟦		X	X	X			
	Manufacturing Detail Development																								X	🟦X	🟦	🟦	X	X	X			
DELIVER	Make Final Prototype																										🟦	🟦X	🟦X	X	X	X	X	
	Evaluation & Final Design Realisation																											🟦X	🟦		X	X	🟦X	X
	Final Submission																																	🟥X

KEY

🟦 Tasks

🟨 Events

🟥 Deadlines

Figure 6. A Gantt chart illustrating the timing of when tasks were planned to be carried out. When they were completed is indicated with a cross.

1.4 THE PROBLEM

Within the UK, 1 in 10 people need a mobility aid to comfortably and confidently traverse 1km independently, safely and in good time (Patel, 2022). In public spaces, in city centres, such as shopping centres and museums, many people can be seen using mobility aids, but this is not reflected within the countryside. Regardless of culture or age, time in natural environments is preferred to that of urban ones (Terese, 2015), and exercise in the countryside has also been shown to have a more significant positive impact on health, both physical and mental, than exercising in cities (Wicks et al., 2022) so it is critical that individuals who use mobility aids are also able to access the countryside.

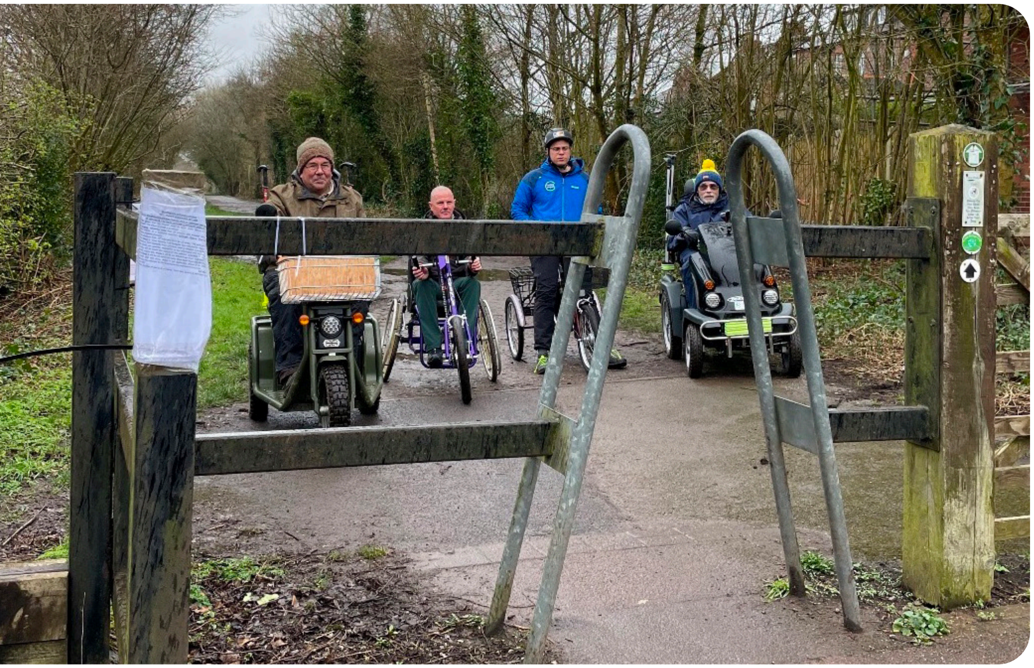


Figure 7. Wheeled mobility aid users blocked by a motorbike inhibitor

> ‘Popping to the shops, a wheel around the park, or A **RAMBLE** IN THE **COUNTRYSIDE** are considered “normal day-to-day activities” as defined under the Equality Act 2010 and SHOULD BE **AVAILABLE TO ALL** AS A RIGHT’
>
> - Shail Patel, 2022

The right of way is the legal protection that allows members of the public in England and Wales to freely traverse the vast network of historic public paths (GOV, 2023c), and this should be extended to individuals with mobility challenges (Patel, 2022). Unfortunately, these individuals face many barriers that often restrict their access. The main barrier is a literal one - gates. When using a wheeled mobility aid, even seemingly easy-to-use gates can be impossible to operate independently, and many are impossible to pass through. This can hurt the individual’s well-being and isolate them from society. This project aims to disrupt the current gate and barriers market with a new accessible barrier.

1.5 THE BRIEF

DESIGN BRIEF: EXISTING COUNTRYSIDE GATES ARE INACCESSIBLE FOR MOBILITY SCOOTER USERS AND CAN PREVENT THEM FROM USING PUBLIC FOOTPATHS AND ENJOYING A RAMBLE IN THE COUNTRYSIDE. THIS PROJECT AIMS TO DEVELOP AND PROTOTYPE THE FIRST GATE FOR UK FOOTPATHS THAT CAN BE OPERATED INDEPENDENTLY AND HANDS-FREE BY MOBILITY SCOOTER USERS WHILE STILL RESTRICTING LIVESTOCK.

This brief was derived from the suggested briefs set out by Shail Patel for the collaborative fair. The full list can be found in Appendix A.

2

DISCOVER

2.1 BACKGROUND RESEARCH

In Britain, the right of way gives the public the legal right to freely traverse a vast network of paths, including Footpaths, Bridleways and Byways. These paths are signposted, and the public is required to stick to them when travelling through (GOV, 2023). In Scotland, there is also the Right to Roam, which gives the public more freedom to travel without being required to stick to paths (GOV, 2023).

FOOTPATHS
For walking, running, mobility scooters or powered wheelchairs

BRIDLEWAYS
For walking, horse riding, bicycles, mobility scooters or powered wheelchairs

RESTRICTED BYWAYS
For any transport without a motor and mobility scooters or powered wheelchairs

BYWAYS OPEN TO ALL TRAFFIC
For any kind of transport, including cars (but they're mainly used by walkers, cyclists and horse riders)

The 2010 Equality Act extended rights to equality of access for minority and vulnerable groups, including individuals with disabilities (GOV, 2023). Under this mobility scooter, users have the same rights to access the rights of way paths as other pedestrians. Businesses and councils must make reasonable adjustments to provide access, including removing physical barriers, and this should be extended to access to rights of ways (Patel, 2022).

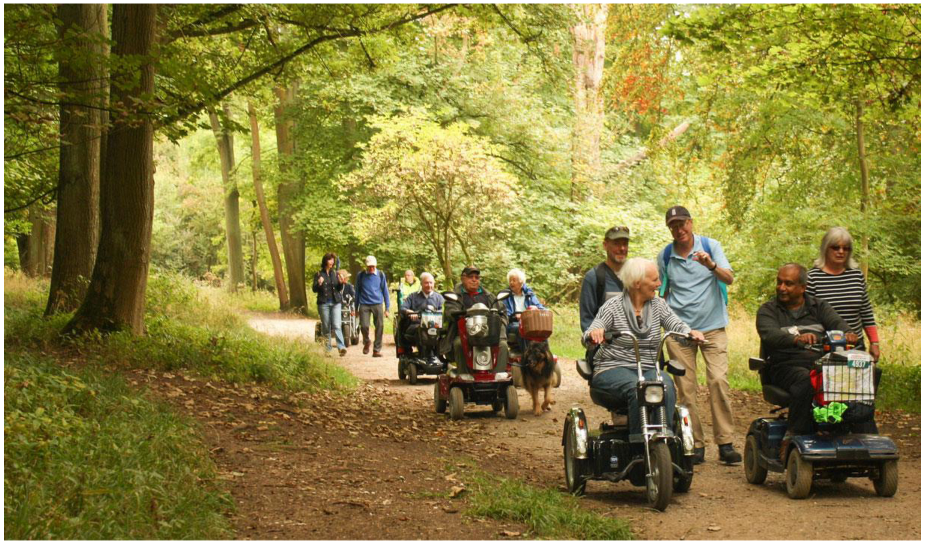


Figure 8. Disabled Ramblers Outing

Just because they legally should have access that doesn't mean they do or that the individuals don't face discrimination. Additionally, there can be conflicts as although there is an exception for mobility scooters in the legislation and they aren't classed as vehicles, this doesn't mean that they are welcome or accommodated (GOV, 2023).

2.2 LITERATURE REVIEW

A thorough review of the prior literature relating to the barriers that individuals with mobility issues face when trying to access the natural environment and rights of way was conducted.

19 Journal articles and reports were reviewed. 6 specifically focus on **barriers to outdoor accessibility within the UK** with the other 13 concerning **barriers to outdoor accessibility from across the world** including North America, and France.

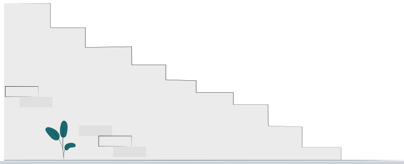
The key themes identified show that a combination of physical, mental and social barriers lead to inaccessibility. The overarching theme is a lack of consideration for the needs of, and accommodations for, individuals with mobility challenges and other disabilities, especially in the countryside (Menzies et al., 2021). Much of the literature recommends that we closely engage with the community and work together to improve this (Burns, Paterson and Watson, 2009).

Key barriers were physical and included steps, stiles and gates, steep inclines and cambers (Candiotti et al., 2017), and under-maintained and overgrown paths.

The combination of these factors leads to fewer people going out, reduced visibility, limited community participation, and isolation. This has negative emotional consequences, feelings of frustration, anxiety and fear (Ripat, Brown and Ethans, 2015) and can worsen physical health conditions (Adams, 2006). This may create a feeling of dependency and being a burden to those around them. This strongly links to the social model of disability, where the environment and society disable an individual more than their actual condition (Adams, 2006).

The limitations of the prior research are that the topics covered are very broad and limited up-to-date, and UK-specific research was available. Additionally, they tended to look through a medical lens without much focus on the feelings of the individuals and often focused solely on older individuals. Conducting up-to-date, relevant research on this specific area is needed. Additionally, what people were affected by was very individual, and everyone's disability affects them differently, so it is crucial to involve a range of participants.

While unpredictable conditions like cold and wet weather cannot be changed, the physical environment and access to needed mobility aids can be, and work should also be done to change societal stigma and attitudes.



INACCESSIBLE OUTDOOR PHYSICAL ENVIRONMENT

‘Accessibility regarding building access has improved according to several participants; however, this has not necessarily been the case in natural environments.’ - Menzies et al., 2021

Adams, 2006; Aguilar-Carrasco et al., 2023; Candiotti et al., 2017; Borisoff, Ripat and Chan, 2018; Burns, Paterson and Watson, 2009; Langdon et al., 2018; Menzies et al., 2021; Mortenson et al., 2020; Musselwhite, 2021; Nix, 1986; Ripat, Brown and Ethans, 2015; Rosenberg et al., 2013; Rouvier et al., 2022; Smith et al., 2021; Terese, 2015; Torkia et al., 2015

NEGATIVE SOCIETAL STIGMA & ATTITUDE

‘Achieving full access for disabled people requires more than a technical fix; it can only be achieved if socio-cultural attitudes are changed as well’ - Burns, Paterson and Watson, 2009

Adams, 2006; Asghar et al., 2020; Burns, Paterson and Watson, 2009; Frank et al., 2010; Menzies et al., 2021; Mortenson et al., 2020; Nix, 1986; Ripat, Brown and Ethans, 2015; Rosenberg et al., 2013; Smith et al., 2021

UNPREDICTABLE OR CHANGING CIRCUMSTANCES

‘poor surfaces, caused by fallen leaves, rain, ice or snow and cluttered or shared pavements’ - Musselwhite, 2021

Adams, 2006; Borisoff, Ripat and Chan, 2018; Frank et al., 2010; Menzies et al., 2021; Mortenson et al., 2020; Musselwhite, 2021; Rosenberg et al., 2013; Ripat, Brown and Ethans, 2015; Terese, 2015; Torkia et al., 2015

LACK OF ACCESS TO NEEDED ASSISTIVE TECHNOLOGY

‘there is a very large gap between those that have access to a relevant mobility aid on a regular basis and those that need it, in the order of 6.2 million people’ - Patel, 2022

Asghar et al., 2020; Menzies et al., 2021; Patel, 2022; Ripat, Brown and Ethans, 2015; Smith et al., 2021

KEY THEMES

2.3 NEED FOR PHYSICAL BARRIERS

Farmers use barriers such as fences to restrict livestock and keep them enclosed within fields. With over 70% of land in the UK used for agriculture (GOV, 2023a), it is no wonder that in many places, footpaths cross through land used for keeping animals. In these instances, gates are necessary to allow people to pass through while still restricting livestock.

Over
70% OF **LAND**
in the UK is used for
AGRICULTURE

Alternatives to traditional gates and barriers are cattle grids and electric fences. However, they are not legal on or around footpaths or bridleways (GOV, 2023b). Cattle grids pose dangers to walkers, dogs and sheep who may get their feet trapped in them, and electric fences pose a risk of electric shock.

ABILITY OF LIVESTOCK
Many types of animals graze in UK fields, including over 22 million sheep and over 3 million cattle (GOV, 2024), each with their own behaviours and abilities. A 2018 paper by McConnachie et al. showed that with enough motivation, such as gaining access to feed or an automatic grooming brush, cattle show lots of determination and can apply significant force to structures and push open gates.

Figure 9. Grazing Sheep

This research revealed a lack of insight, academic or otherwise, on the wants and needs of farmers within this context, as well as animal behaviour, in particular sheep, in relation to gates, and no research into the intersection between animal behaviour and accessibility. Much information will be known to farmers but not well recorded; this project will strive to research this area and fill the knowledge gap.

2.4 KEY STAKEHOLDERS

The primary stakeholders are individuals with mobility challenges who use wheeled mobility aids. It is also essential to consider the key secondary stakeholders of landowners and stewards, as well as other pedestrians.

WHEELED MOBILITY AID USERS
Pedestrians using a range of mobility vehicles that should have access to the footpaths just like anyone else.

LANDOWNERS & LAND STEWARDS
They own or look after the land that the footpaths cross through and have livestock that they want to keep safe. They have a legal obligation to keep the footpaths unobstructed.

OTHER PEDESTRIANS
Other users of the paths. Including ramblers, dog walkers and, in the case of bridleways, horse riders.

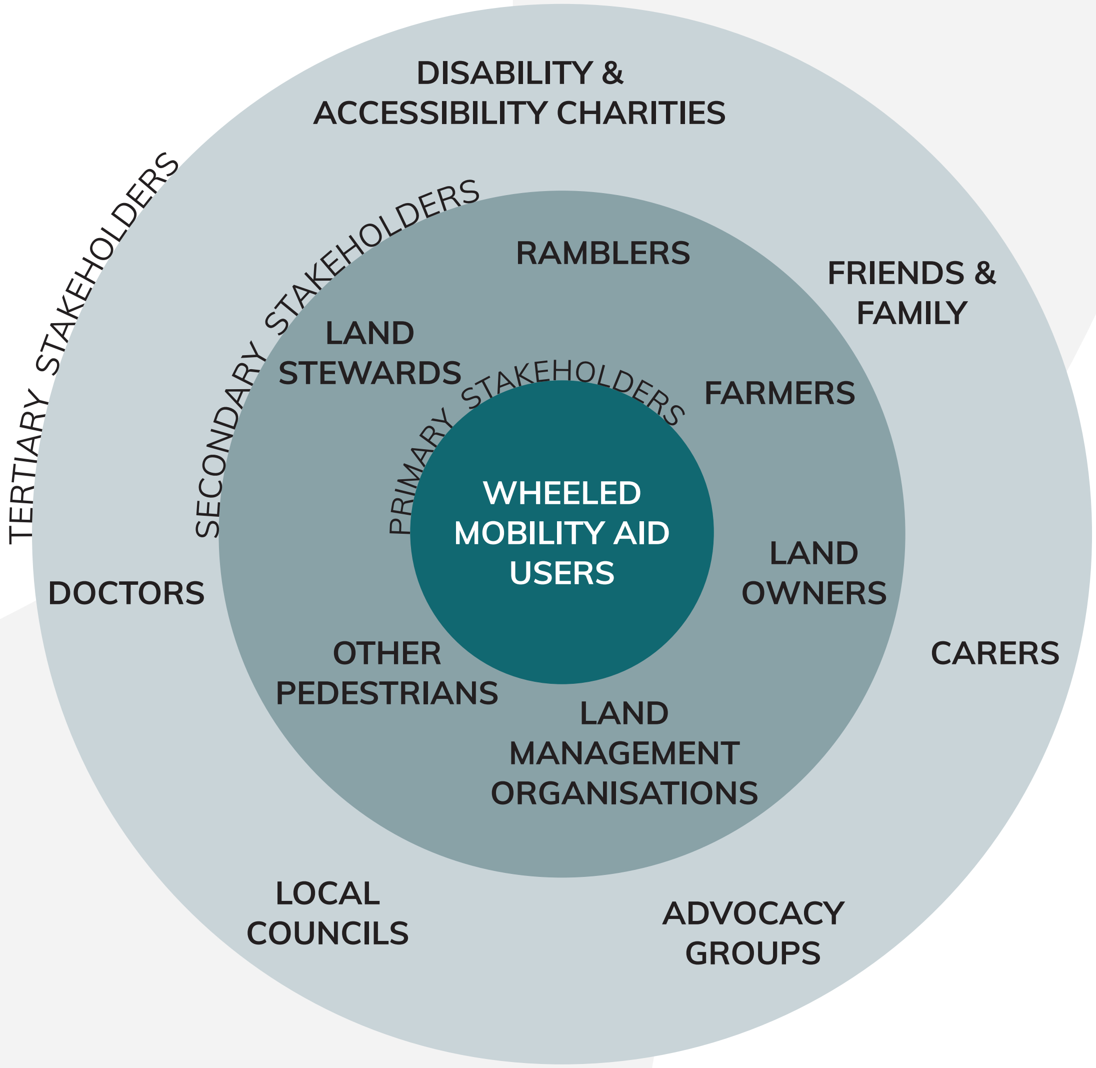


Figure 10. Stakeholder Map

2.5 ACCESSIBILITY PROGRESS

Everyone should be able to access the countryside but there are barriers for many minority groups. Despite this, in recent years the number of people in minority groups, including individuals with disabilities, who are accessing the countryside has been rising (MENE, 2019).

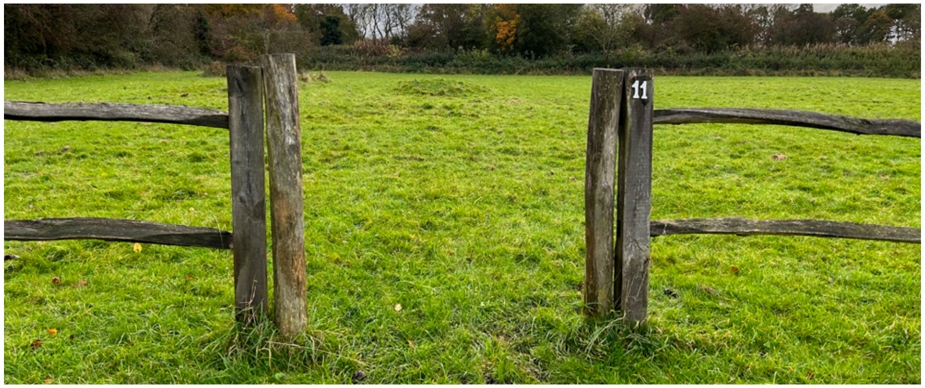


Figure 11. A gap instead of a barrier

BS5709:2018 is the British Standard for Gaps, Gates and Stiles. It sets out a clear framework of guidelines relating to these barriers that should be adhered to. An open gap is always the best option where possible, and it encourages gates that are not in use to be tied open to improve access. It also outlines technical specifications, required distances etc. Its limitations are hard to enforce and focuses on future installations not altering existing structures. Some further work is also being done to improve access, including the publication of the outdoor accessibility guidance booklet (Sensory Trust, 2023) that gives detailed information on what can be done to make the countryside more accessible, encompassing a broader range of considerations, such as accessible facilities and recreation areas.

THE ACCESSIBLE GATES WORKSHOP

When gaps are not feasible, advocates call for the use of 2-way easy latch gates, currently the most accessible option available. The Accessible Gates Workshop hopes to go further by redesigning the current gates and developing new ones to create a new accessible barrier that is actually fit for purpose (Patel et al., 2024). Most of the projects they are working on are modifications to the current gates that could be retrofitted to improve their accessibility or would require the use of one hand, not both. One of these that has started to be implemented is the redesigned easy latch handle, which has larger loops that are easier to lift with a walking stick. The author's challenge is to go even further than this and look at a solution that is entirely hands-free for the user.

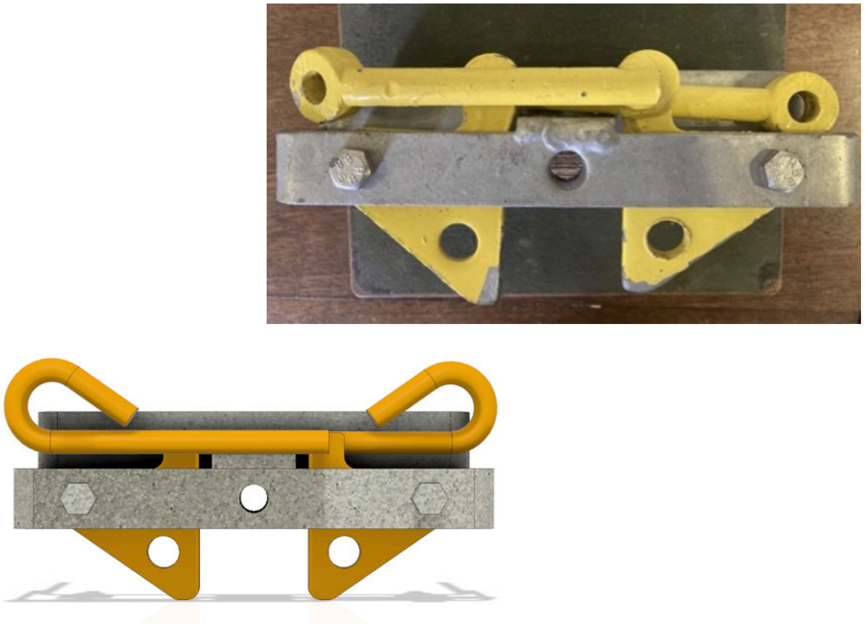


Figure 12. New easier to use easy latch (Centerwire, 2023)

2.6 METHODOLOGY

This project will follow a participatory design process by collaborating within this diverse team and centring the core user group and other key stakeholders' inputs throughout the design process, in the initial research, and through the concept development and realisation. Therefore, a qualitative research approach, including semi-structured interviews, was used. Often, many assumptions are made about what individuals with mobility challenges can and cannot do. Directly involving the user group is critical as it will empower them to have their say and ensure the success of this project.

The Quarterly Accessible Gates Workshop will also provide the opportunity to get feedback from a range of experts and collaborate on concepts. Initially, the intention was to do observational ethnography and in-person testing with users; however, this was not able to be approved by the ethics board in a reasonable time frame. Therefore, autoethnography, self-testing, and evaluation with key stakeholders were used. In the long term, physical testing with real participants would ideally be used. This study was approved by the Brunel Ethics Board (evidence of which is in appendix B).

SEMI-STRUCTURED INTERVIEWS

The semi-structured interviews were open-ended to allow the participant to lead the conversation and provide more detailed insight than surveys (example questions can be found in appendix C). These will be conducted with the two key user groups.

AUTOETHNOGRAPHY

Autoethnographic artefact analysis was chosen by the author to test out a variety of wheeled mobility aids with existing footpaths and bridleway gates. Additionally, wearing gloves and remaining seated was implemented as an empathy test.

ONLINE EVALUATION

The concepts and prototypes will be virtually presented at various stages of development to key stakeholders through semi-structured interviews and Accessible Gates Workshops for feedback and evaluation.

2.7 PRIMARY RESEARCH KEY FINDINGS

A range of individuals who used different mobility aids were interviewed. Their motivations to get out into the countryside varied, but what they had in common was experiencing inaccessibility. Further details about them and key excerpts from the transcripts can be found in Appendix F.

The participants gave anecdotes about the key barriers, which aligned with those found in the literature review. However, a new theme also emerged: a lack of information, which made them worried about going out and often led to negative experiences. Additionally, perceived inaccessibility was found to be equally as bad as physical inaccessibility. If there is no way to know if a path is accessible, then it is not accessible. The overall attitude was that there is often a lack of consideration and care from many members of the general public, councils and farmers.

They were also asked about how these barriers affect them. These barriers made them concerned for their safety, such as getting stuck. For Participant 3, this meant that she doesn't go out as often as she would like to. It also limited their independence and made them feel like they had to rely heavily on others. Participant 5 was particularly frustrated with his loss of spontaneity as so much extra planning and preparation was needed if he wanted to go out.

NEW THEME: **LACK OF INFORMATION**
“I think. I think the crux of it is that **I probably haven’t explored as much as I would like because I worry about not not finding that sort of, you know, set up really**.” - P3

“There were gates and **you never knew if they were going to be open or shut**.” - P1

“just feel that **you can’t kind of go into the more remote places because you’re probably more likely to encounter accessible access issues**” - P3

“But, but **I’m entirely reliant on other people.** So that means that I’m entirely reliant in terms of routes. How do I know?” - P5

INACCESSIBLE OUTDOOR PHYSICAL ENVIRONMENT

“I bought an all-terrain scooter and then found that I still couldn’t get out into the countryside, cause they kept putting obstacles in my way, mainly gates.” - P1

“Many times barrier to good accessible place is a gate at the car park or spaces too small” - P2

“They have a gap like that, but they have a pole across the gap that you have to step over …Horses can step over it. Cyclists can lift their stuff up. And I’m told by motorbikers… they could jump it” - P4

“Supposedly wheelchair accessible kissing gates.. I can just about get my scooter in and out, It’s a bit of a jiggle as you’ll see. It’s taken me, got to be 12 months… trying different methods of getting in and out them” - P1

UNPREDICTABLE OR CHANGING CIRCUMSTANCES

“To be honest, it’s much, much better in the summer when it’s dry because that’s the other factor is mud.” - P3

“the gate next to it had a padlock on it. The number for the Rangers that was on the notice board next to that and no one was answering.” - P5

“Mud. I try to avoid getting too muddy if I can avoid it. Since it’s an electric motor in the hub, I wouldn’t want to go too deep since there is a risk of submerging it.” - P2

“Can’t go there at the moment, cause part of it’s flooded” - P4

NEGATIVE SOCIETAL STIGMA AND ATTITUDE

“It’s probably a slight psychological angle as well that I don’t kind of want to, you know, I guess [mobility scooters] are always connected a bit with the elderly.” - P3

“we’ve been arguing with the Forestry Commission for at least five years to get them removed and that kind of shows the brick wall attitude, you know”. - P4

“Some of them are too proud to use a mobility scooter. They’d rather sit at home and knit all day” - P1

LACK OF ACCESS TO NEEDED ASSISTIVE TECHNOLOGY

“There needs to be a variety cause we all have different needs and one size doesn’t fit all” - P1

“The trouble with most rental, most countryside centres use Trampers, Trampers have twist throttles and I can’t use a twist throttle I have to have a paddle” - P1

“And your mobility allowance through PIP in my case is really not sufficient because if you end up having to make a choice …it’s either this or that. You can’t have both …if you were going up Snowdon would you wear the shoes you got on today? No. I’d have walking boots. And I said exactly the same with somebody with wheelchairs and mobility aids. You need different aids for different situations.” - P1

2.8 USER PERSONAS

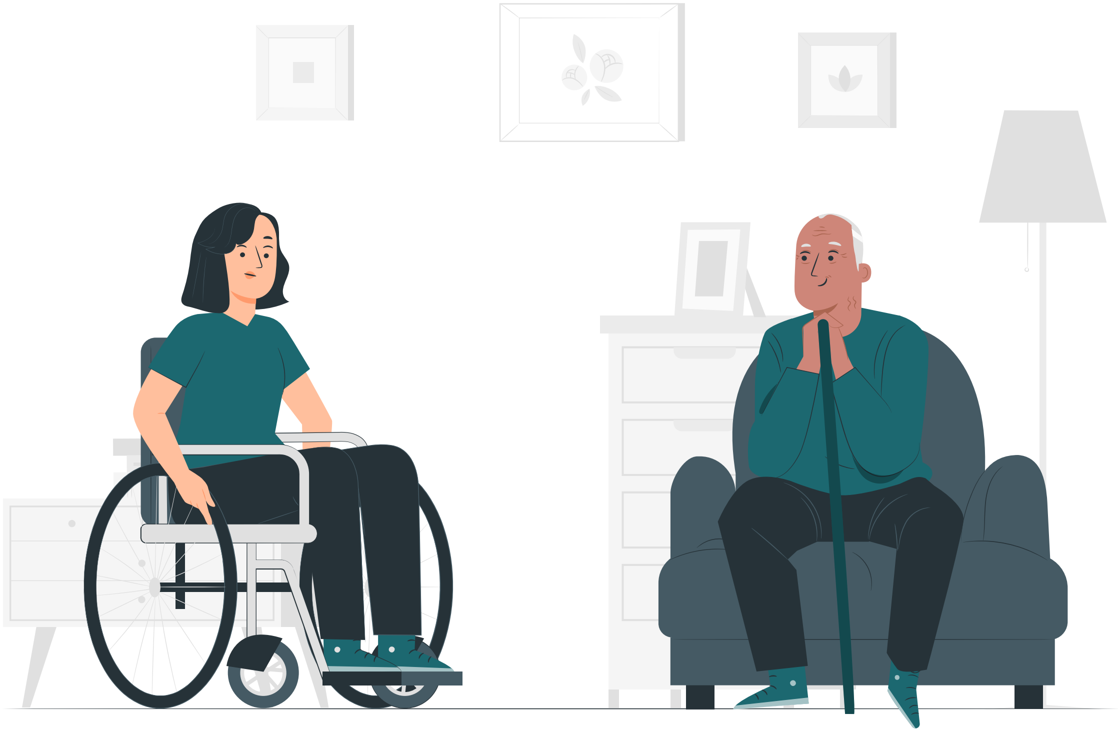
NAME: Rebecca

AGE: 34

LOCATION:
Greater London, UK

MOBILITY CHALLENGE:
She experienced an injury causing paraplegia (paralysis from the waist down).

KIT:
Uses her manual wheelchair with an electric Tri-wheel add-on.



NAME: Geoff

AGE: 62

LOCATION:
Cumbria, UK

MOBILITY CHALLENGE:
He developed a degenerative condition in later life, affecting his mobility and causing chronic pain.

KIT:
Uses a Tramper all-terrain mobility scooter.

OUTINGS & TRAVEL: Goes out alone or with friends. She usually goes out locally and sometimes gets the train.

DIFFICULTY WITH CURRENT GATES: She cannot lean forward far enough from her chair to reach the latch and finds it hard to position the chair correctly.

WHY THEY DO IT: She does it for her mental health and to stay fit.

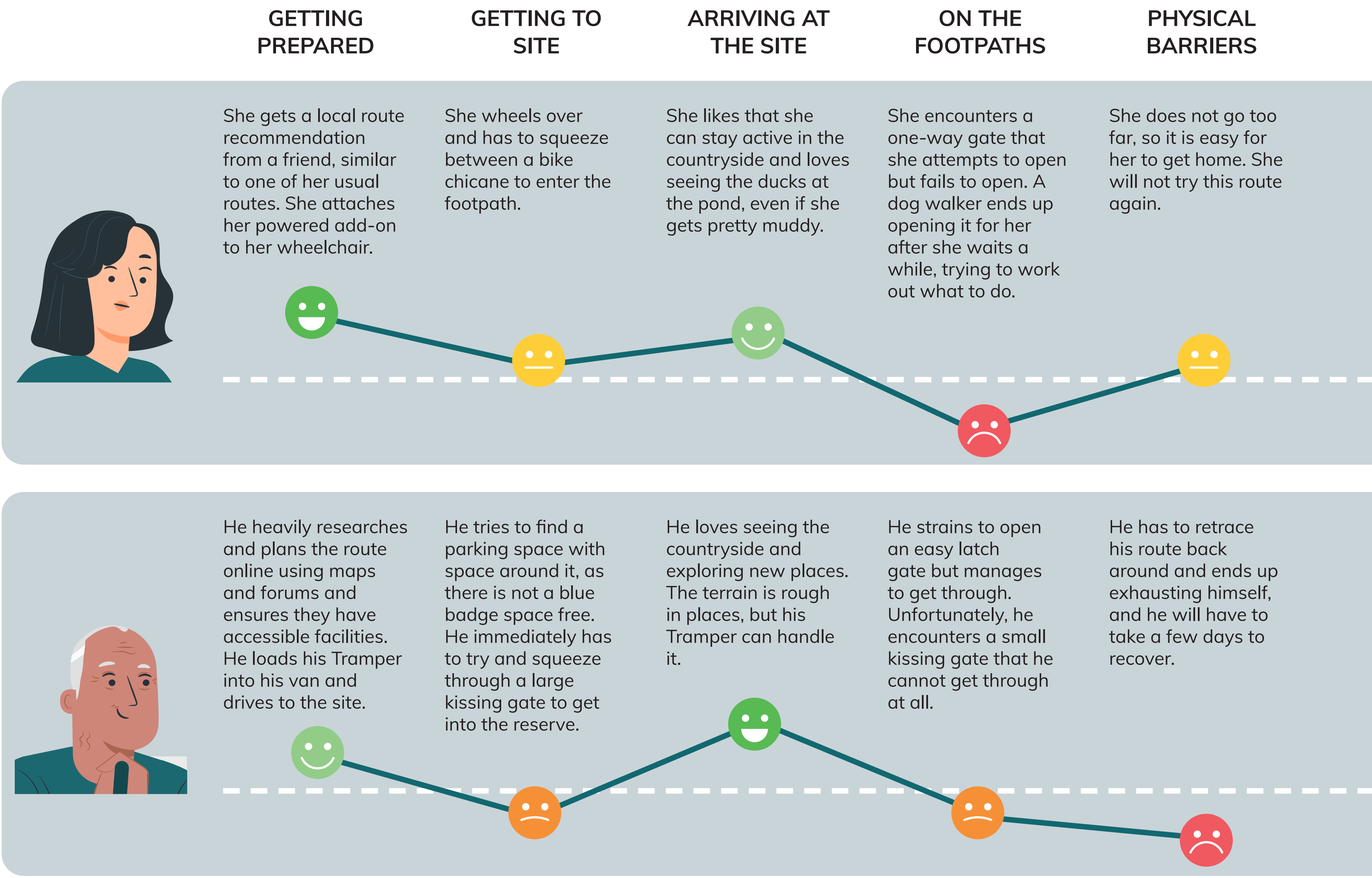
OTHER NOTES: She likes to go at her own pace. She does not consider using a mobility scooter as they have a stigma that they are for older individuals.

OUTINGS & TRAVEL: He has an accessible van. He usually goes on organised rambles with groups and wants to go alone but struggles as it is often inaccessible.

DIFFICULTY WITH CURRENT GATES: He finds coordinating opening the gates painful, exhausting and challenging.

WHY THEY DO IT: He loved walking and hiking when he was younger and wants to keep doing it.

OTHER NOTES: He looks out for accessible facilities. He wishes he could go out more.

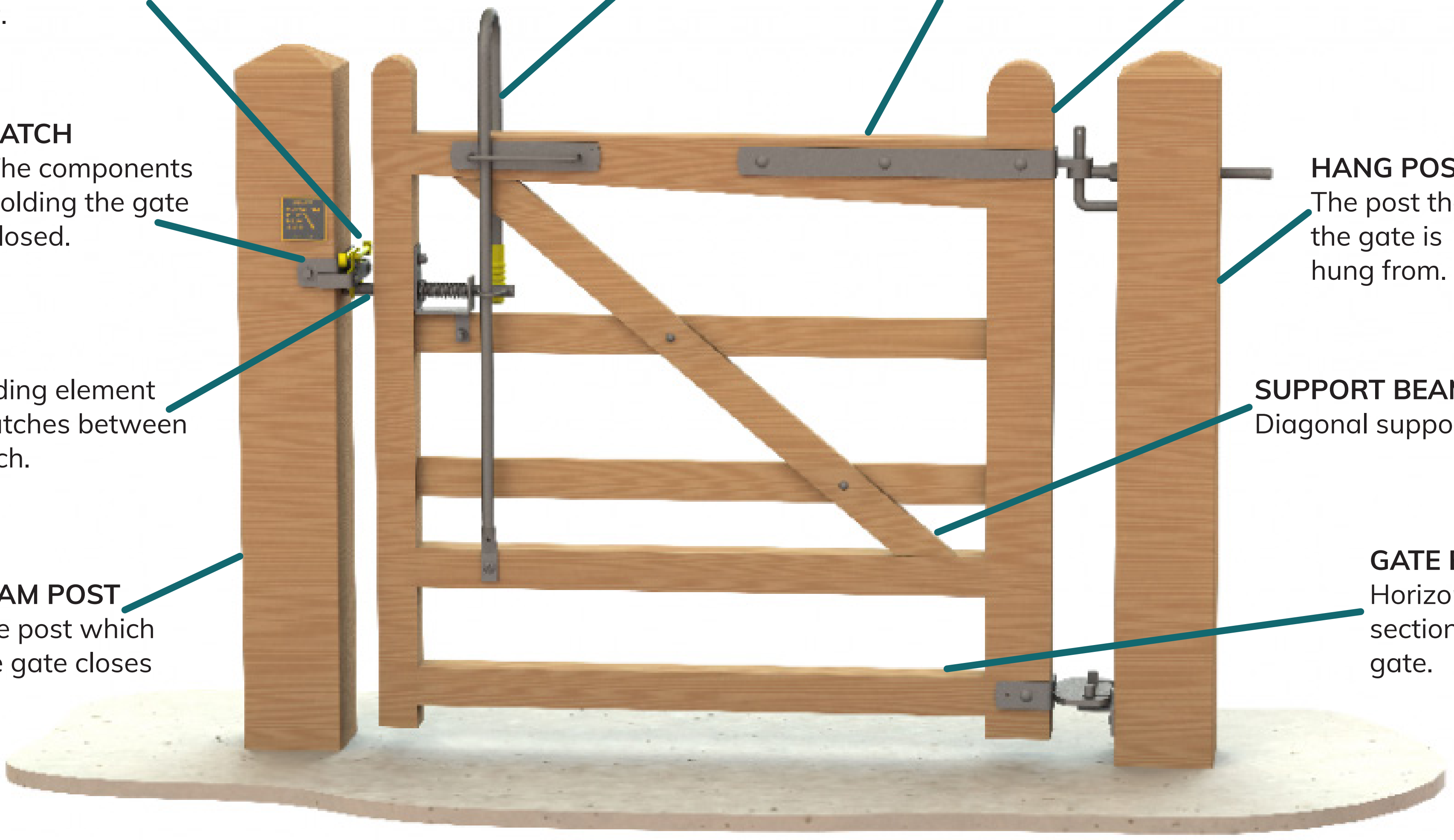


	GETTING PREPARED	GETTING TO SITE	ARRIVING AT THE SITE	ON THE FOOTPATHS	PHYSICAL BARRIERS
	She gets a local route recommendation from a friend, similar to one of her usual routes. She attaches her powered add-on to her wheelchair.	She wheels over and has to squeeze between a bike chicane to enter the footpath.	She likes that she can stay active in the countryside and loves seeing the ducks at the pond, even if she gets pretty muddy.	She encounters a one-way gate that she attempts to open but fails to open. A dog walker ends up opening it for her after she waits a while, trying to work out what to do.	She does not go too far, so it is easy for her to get home. She will not try this route again.
	He heavily researches and plans the route online using maps and forums and ensures they have accessible facilities. He loads his Tramper into his van and drives to the site.	He tries to find a parking space with space around it, as there is not a blue badge space free. He immediately has to try and squeeze through a large kissing gate to get into the reserve.	He loves seeing the countryside and exploring new places. The terrain is rough in places, but his Tramper can handle it.	He strains to open an easy latch gate but manages to get through. Unfortunately, he encounters a small kissing gate that he cannot get through at all.	He has to retrace his route back around and ends up exhausting himself, and he will have to take a few days to recover.

Figure 13. User journeys derived from user interviews

A DAY OUT IN THE COUNTRYSIDE

2.10 MARKET ANALYSIS



PAWL
The levering section of the latch, used to open it.

TROMBONE HANDLE
A handle that curves over the top of the gate and provides a secondary method of opening, generally for horse riders.

GATE LEAF
The main body/panel of the gate that opens and closes.

GATE STILE
Vertical up right section of a gate leaf, usually the outermost uprights.

LATCH
The components holding the gate closed.

HANG POST
The post that the gate is hung from.

BOLT
Protruding element that catches between the latch.

SUPPORT BEAM
Diagonal support.

SLAM POST
The post which the gate closes to.

GATE RAIL
Horizontal section of a gate.

Figure 13. Labelled Centrewire 2 way easy latch gate

AUTOETHNOGRAPHY

Autoethnography was conducted using a Tramper Mobility Scooter at the COAT. Testing was intended to be conducted with a range of vehicles; unfortunately, only the Tramper was used due to the wet ground conditions. Further details of the testing are in Appendix C.

The gates were evaluated based on their accessibility in a tramper and their ability to block livestock. Their accessibility when using other wheeled mobility aids and common difficulties, including limited mobility, were also considered in this evaluation. The trend in the current market shows a trade-off between accessibility and blocking livestock. There is a significant gap in the market for a truly accessible gate designed to block livestock.

KEY

1 1-way Easy Latch Gate
2 2-way Easy Latch Gate
3 2-way Easy Latch Gate, no Self-Close
4 Chicane Barrier
5 Gap
6 Horse Stile
7 Kissing Gate
8 Kissing Gate with Radar Bypass
9 Large Kissing Gate
10 Motorbike Inhibitor
11 Stile

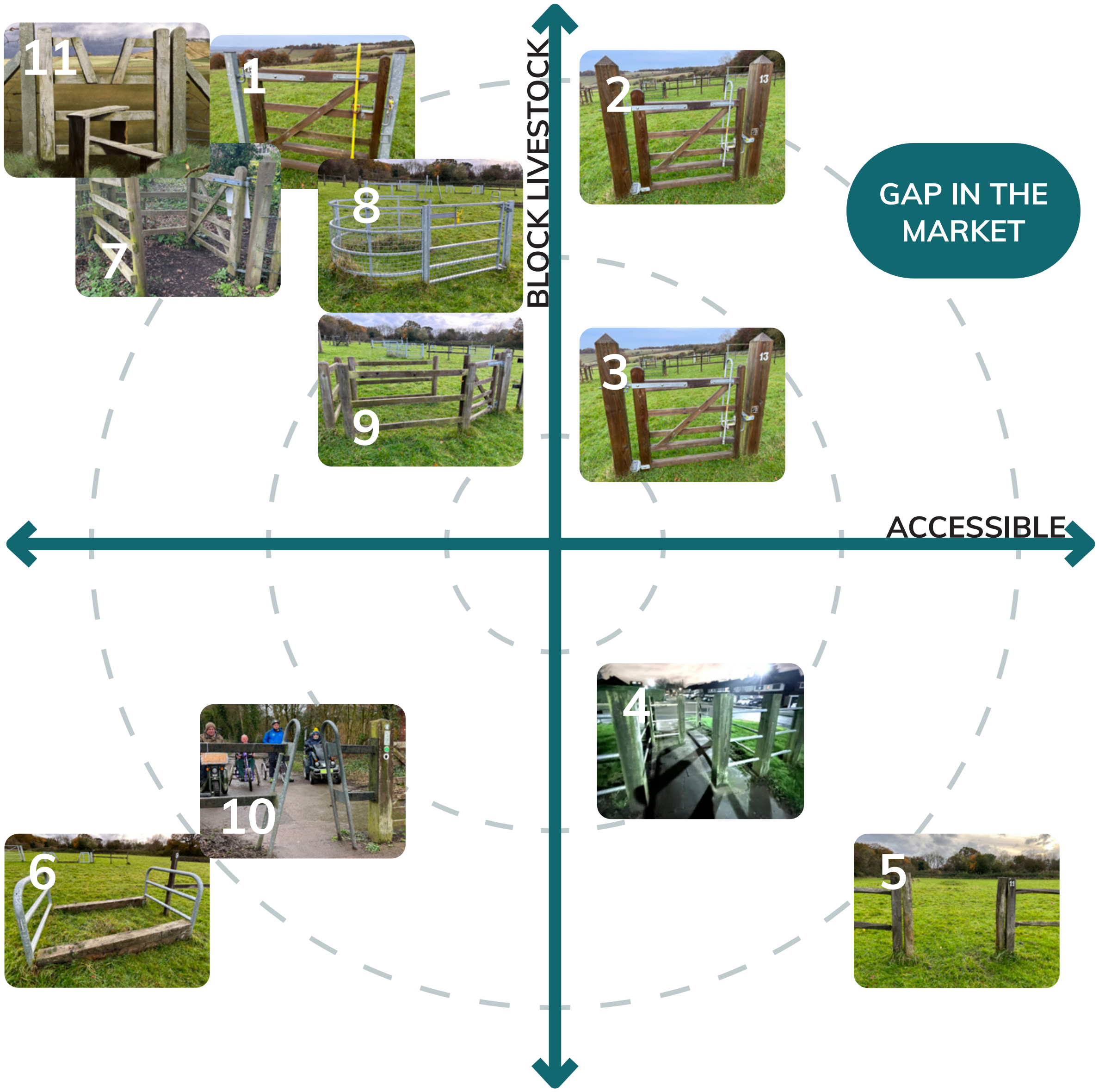
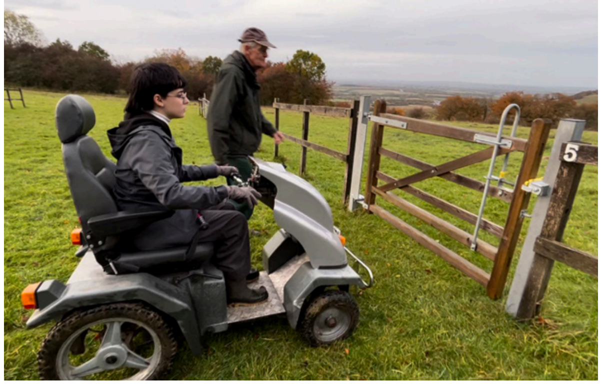


Figure 14. Perceptual Mapping of current gates and barriers primarily based on autoethnographic testing

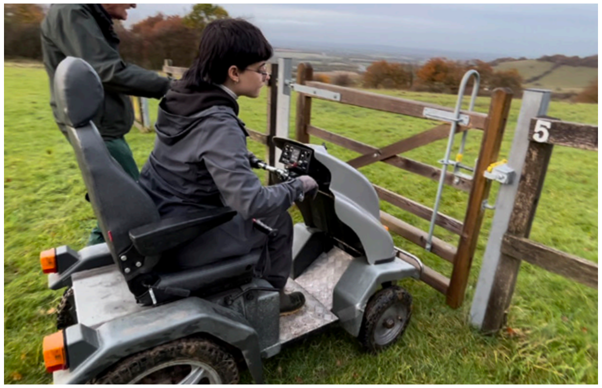
EASY LATCH GATES

Easy latch gates can be opened easily from both sides; lift the pawl and push. It automatically relatches as the gate swings closed. It also has a bypass with a handle for horse riders. The storyboard below shows the author trying to navigate through the 2-way easy latch gate independently.

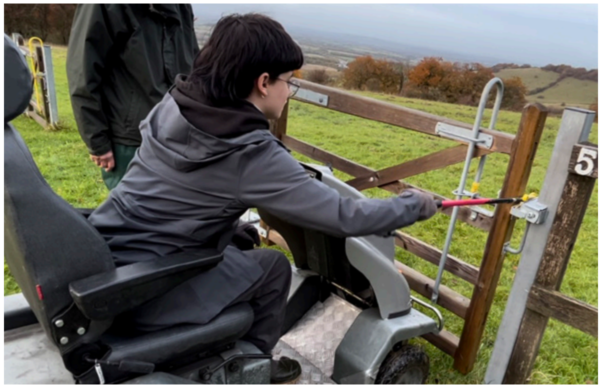
The easy latch gate is currently regarded as the most accessible barrier (Patel et al.,2023); however, an informal survey conducted by the accessible gates workshop in the Disabled Ramblers Facebook group found that even this gate was inaccessible to most of the individuals in the group (Wilson et al., 2023).



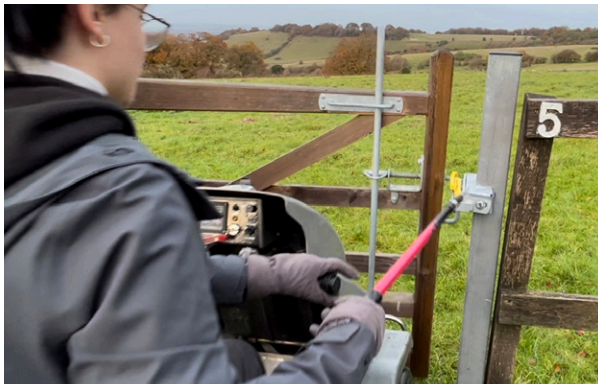
1. Roll up to the footpath gate and assess what type of gate it is and what the appropriate approach is.



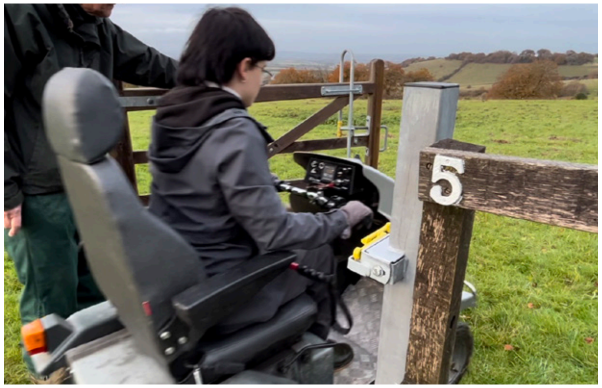
2. Reverse back and realign as needed so that your wheeled mobility aid is closer to the latch side of the gate.



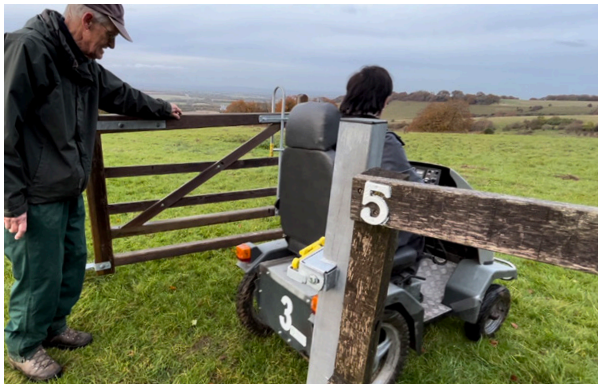
3. Use a walking stick to reach and hold open the latch. If mobile enough, you can stand up and reach over to it.



4. Simultaneously, use the other hand to turn the throttle and drive slightly forward, pushing the bolt out the latch.



5. Remove the stick and continue slowly forward while using your other hand to hold or swing the gate open.

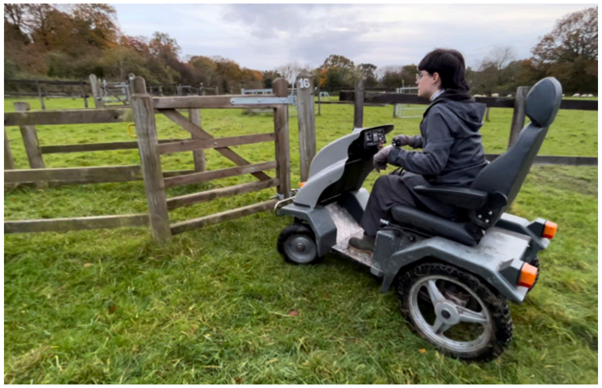


6. Stop holding the gate and continue through whilst trying not to get hit as the gate self-closes.

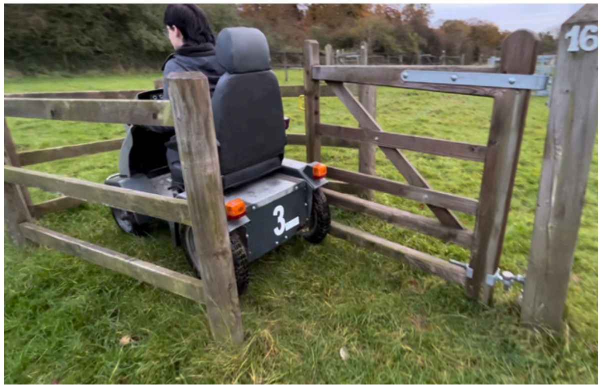
‘ACCESSIBLE’ KISSING GATES

Kissing gates have a small enclosure and a hinged gate leaf that swings between the 2 posts, kissing (touching) against them. They allow people but not livestock to pass through. There are 2 types of ‘accessible’ kissing gates - kissing gates with radar bypass and large kissing gates (as seen below).

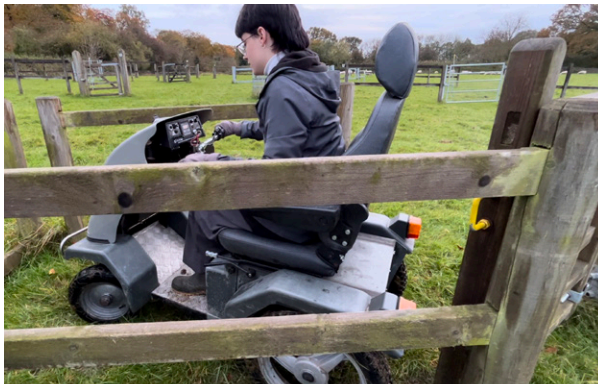
The radar bypass opens the gate leaf past the posts. Radar keys work indoors but are insufficient for outdoor use (Patel et al.,2023). The large kissing gate aims to accommodate a wheelchair or mobility scooter within its enclosure. It is often mistakenly thought to be the most accessible; however, it is challenging to get through.



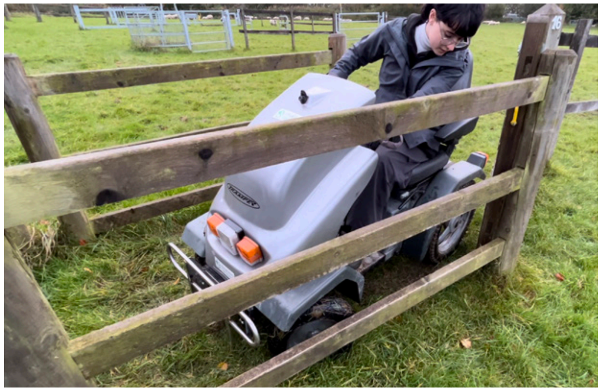
1. Roll up to the kissing gate and assess if it is big enough to fit you and your wheeled mobility aid.



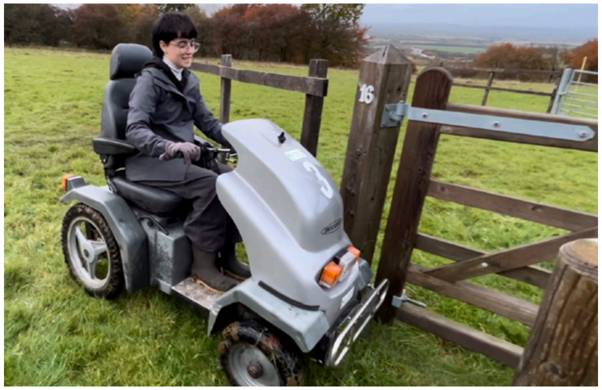
2. Drive forward through the gate leaf (first reverse and realign if needed).



3. Pull far enough into the enclosure that the gate leaf closes behind you.



4. Attempt and attempt again to align up to reverse out (this took over 5 minutes).



5. Eventually, line up correctly and reverse out of the gate’s enclosure.

It took the author over 5 minutes to pass through, with a lot of reversing and realigning needed to get out. The process is even more complicated when approaching from the other side, as the gate leaf must also be held open.

OTHER GATES

Further research was conducted into gates used for applications other than footpaths.

BROUGHTON MOOR CYCLIST GATE

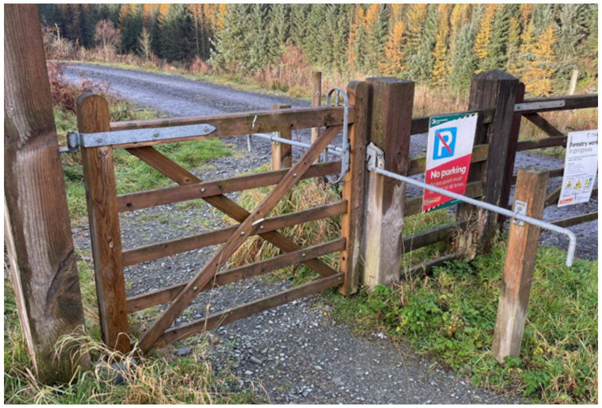


Figure 15. (Patel et al., 2024)

This gate is a one-off installation found at Broughton Moor and is designed for recumbent cyclists (Patel et al., 2023). The gate's latch is opened by the handle, which is affixed a little distance from the gate.

Wheeled mobility aid users could open this with one hand as it can be reached from the vehicle, and the latch stays open until the gate self-closes. It is unknown whether this gate would be livestock-proof, but it is unlikely, as animals may be able to pull on the handle to open it.

BUMP AND DRIVE VEHICLE GATE

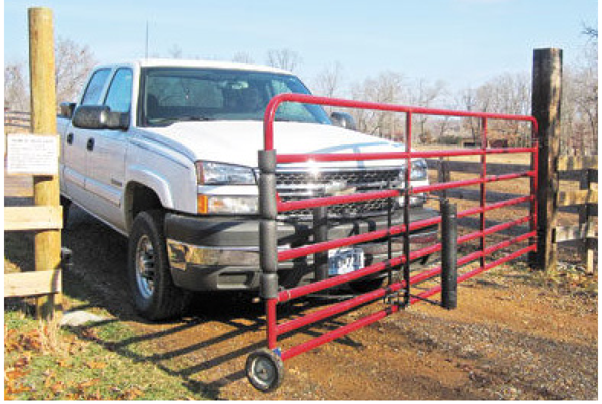


Figure 16. (Progressivecattle, 2011)

Redesigned in the US by Arkansas ArgAbility (Chou and Welch, 2024) and also seen in Australia, these gates are designed for hands-free ranch entrance. Vehicles drive into a V-shaped part protruding from the gate attached to a wire that pulls the bolt out of the latch to open it (BumpN'Drive, 2019). Some manufacturers claim they are stockproof (BumpN'Drive, 2019), but this is not verified and seems unlikely when Bump Gates modified with bristles have been used to allow cows to operate the gates intentionally (Barasona et al., 2013). They can be used with cattle grids (bumpndrive, 2019) but these cannot be used on footpaths.

DRIVE THROUGH VEHICLE GATE

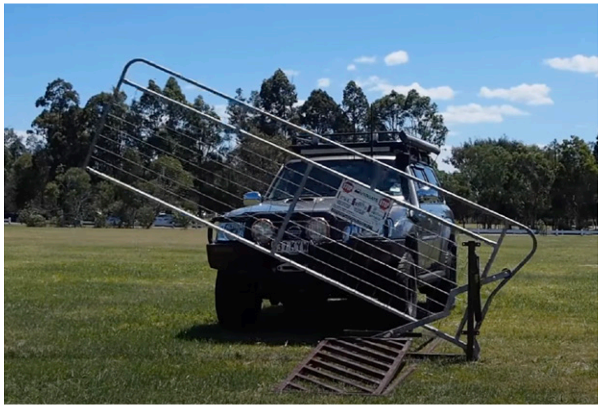


Figure 17. (Simonelli, 2017)

This mechanical gate uses the force of the car on a plate on the ground and hydraulics or weight to pivot the gate out of the way and allow the car to drive straight through. There are similar concepts where the gate slides away to the side instead (Green, 2015).

Using this to make a gate livestock-proof may be a challenge, especially as there is less weight difference between mobility scooters and livestock.

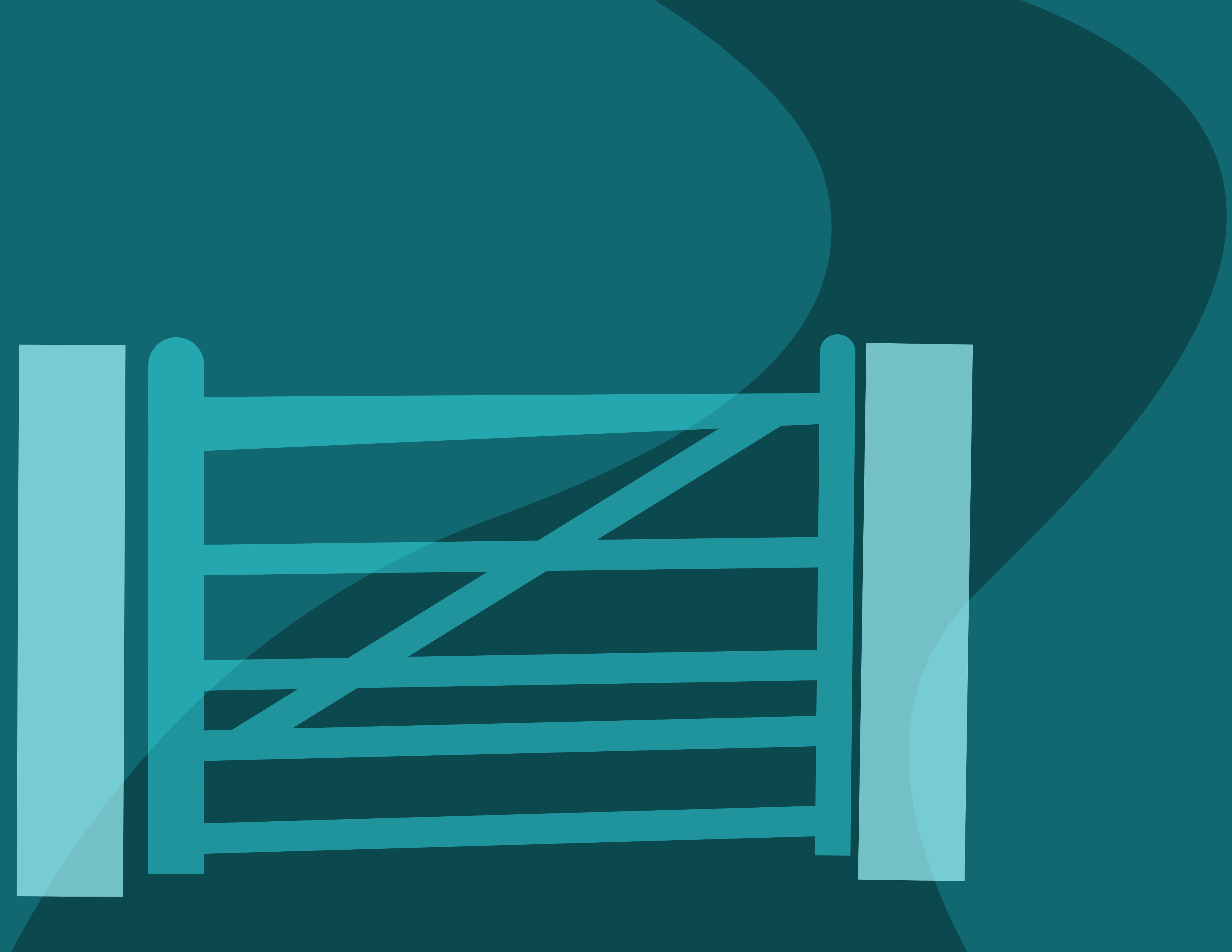
2.12 INITIAL RESEARCH CONCLUSION

Improving the accessibility of the countryside and rights of way in the UK is a critical issue that needs to be addressed, with the current gates all being insufficient for the needs of wheeled mobility aid users. This causes a conflict in situations where barriers are required to restrict livestock, so exploring how the needs of both groups can be met is crucial to this project.

This research showed that the needs of individuals are varied and complex, but many face the same barriers and firmly believe that a lack of involvement of disabled individuals when making decisions about accessibility is the main issue. Continuing the involvement of the user group is critical, as well as the involvement of the collaborative team and land owners will be key to the success of this project. Changing societal opinion and improving communication will come with time, but the physical barriers are a good place to start.

This area has had little innovation and design input, and this needs to change. It lends itself to a low-tech solution for affordability and longevity, so exploring how existing mechanisms can be adapted and applied in this new context is crucial to progress. Quick progression physical modelling is key to visualising the mechanisms and exploring human factors in a 3D space.

Improving access for individuals with mobility challenges will help not just the individual but also society as a whole, bringing together communities and improving access for everyone, now and in the future.



DEFINE 3

3.1 REDESIGNING THE BRIEF

The brief was redefined based on the review of prior research, user group interviews and market analysis. More emphasis is now placed on considering a wider range of individuals' needs and wheeled mobility aid vehicles to create the most accessible solution. It also ensures that it uses minimal technology, such as electronics, and minimal additional materials to keep production and maintenance costs low. An initial product design specification was also created, which can be found in appendix G.

DESIGN BRIEF: EXISTING COUNTRYSIDE GATES ARE INACCESSIBLE FOR USERS OF WHEELED MOBILITY DEVICES AND CAN PREVENT THEM FROM USING PUBLIC FOOTPATHS AND ENJOYING A RAMBLE IN THE COUNTRYSIDE. THIS PROJECT AIMS TO DEVELOP AND PROTOTYPE THE FIRST LOW-TECH GATE FOR UK FOOTPATHS THAT CAN BE OPERATED INDEPENDENTLY AND HANDS-FREE BY WHEELED MOBILITY DEVICE USERS WHILE STILL RESTRICTING LIVESTOCK.

3.2 INITIAL IDEAS

The most straightforward approach identified by the author was using a push plate or a bump gate style mechanism, seen in concept one and combining it with the 2-way easy latch. Unfortunately, this alone is not livestock-proof.

The key to this project is identifying the physical and cognitive similarities and differences between the wheeled mobility aids and their users, as well as the livestock. The variety of mobility vehicles and individuals' abilities, as well as the variety of livestock, makes this more complex.

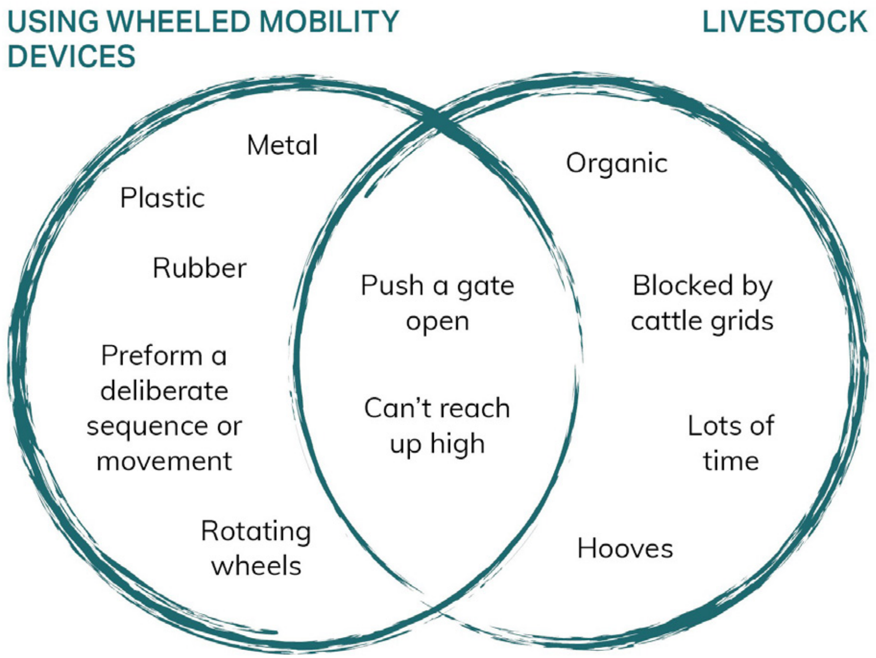
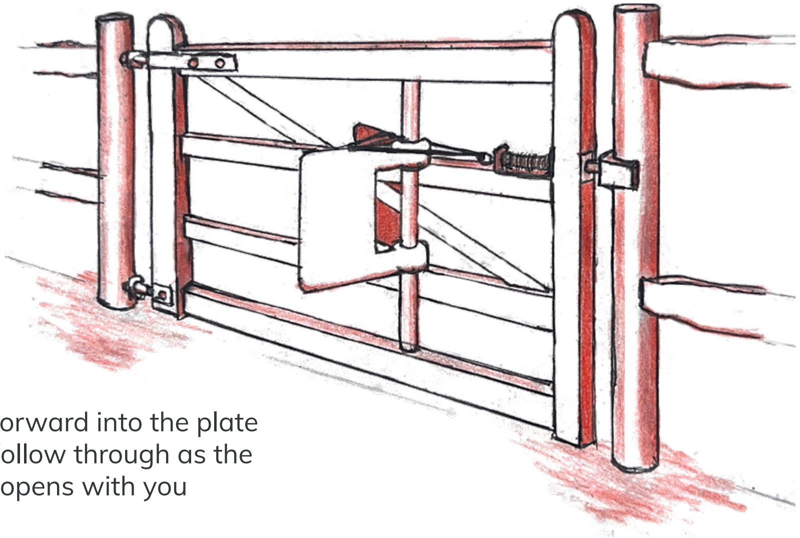


Figure 18. Venn diagram showing the similarities and differences between livestock and individuals using wheeled mobility aids



Roll forward into the plate and follow through as the gate opens with you

1. PUSH PLATE

Uses spring loaded pin to circumvent the 'easy latch'

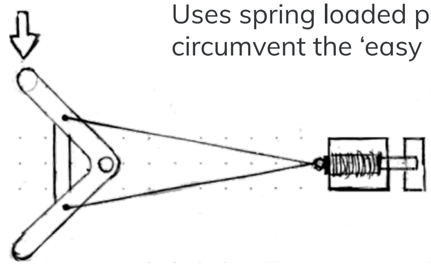


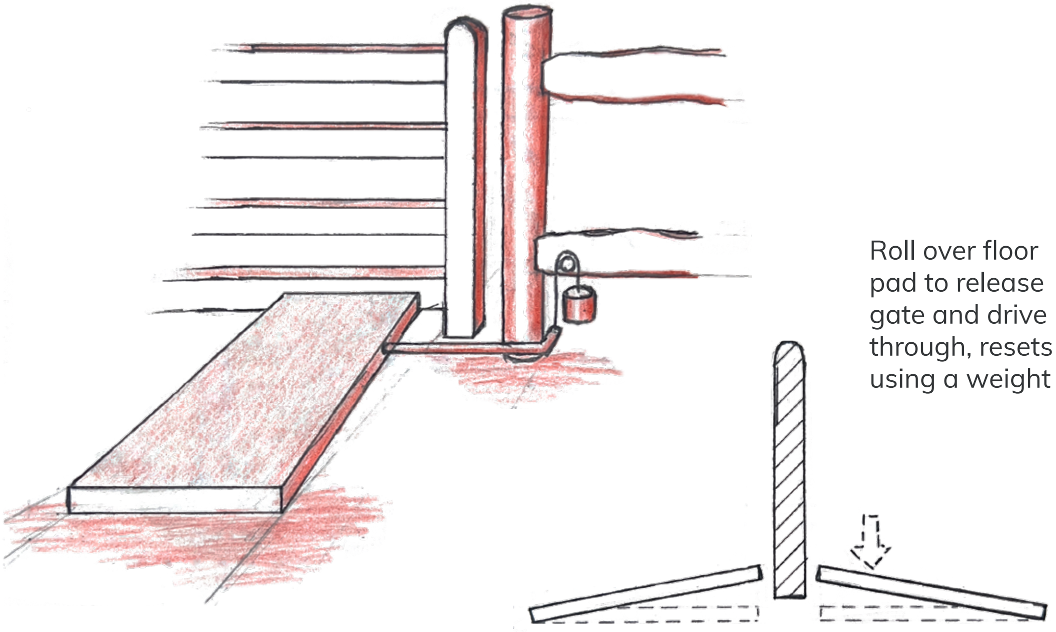
Figure 19. Initial concept 1

From this, it was identified that a series of operations or two simultaneous operations would be needed to block livestock. However, this is hard to achieve from within a mobility scooter. Concept two shows some possible routes to explore this within. The primary drawing shows a concept that fully blocks gates; however, there are many variations to explore. These ideas also look at how the material or motion of the wheels may be used to differentiate between the users and livestock. There is significant room for development to improve these initial thoughts.

The third concept focused on making a stock-proof variation of the Broughton moor gate (Patel et al., 2024). Replacing the hooked handle with a magnetic end recessed into a post to prevent animals from opening it. The user would fix a magnet on the front of their vehicle, which would be used to unlock the gate. They would have to reverse up while using it, but this would be an overall easier-to-perform sequence.

2. SEQUENCE

Combined with the push plate to restrict livestock, alternative versions could involve pneumatic tubes or unlock by using the wheels rotation



Roll over floor pad to release gate and drive through, resets using a weight

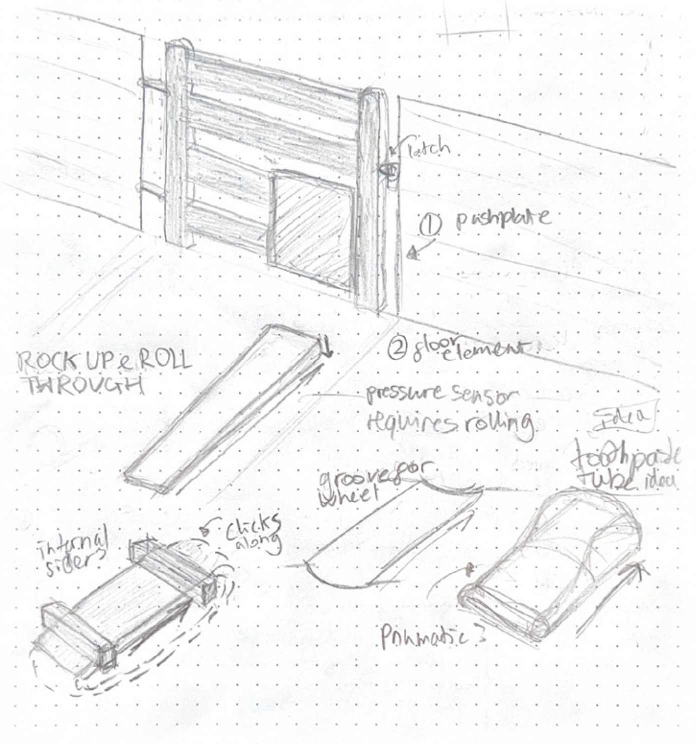
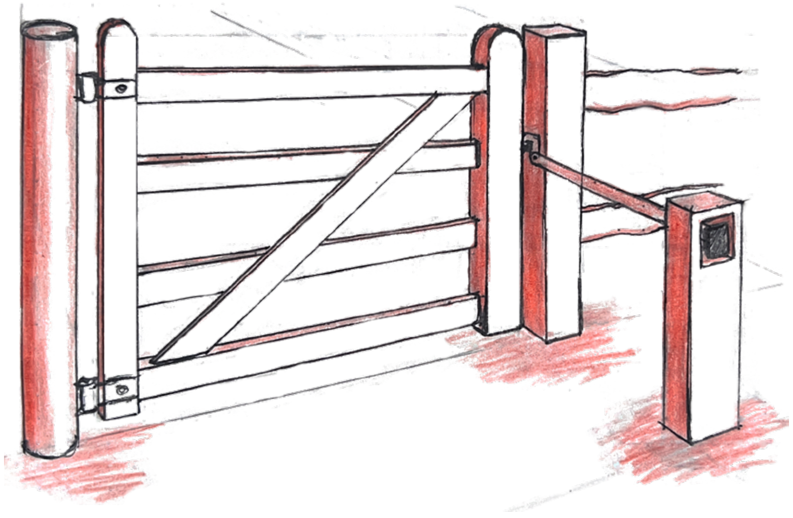


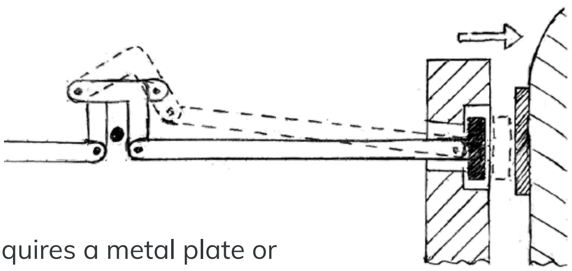
Figure 20. Initial concept 2

3. MAGNETIC LATCH

Roll up to latch, allowing the latch to attach to the mobility device and reverse slightly, then wheel through the gate



Latch remains open until reset by the gate self closing



Requires a metal plate or magnet to be fixed to the front of the mobility device

Figure 21. Initial concept 3

ACCESSIBLE GATES WORKSHOP KEY FEEDBACK

This workshop was primarily to discuss and evaluate accessible barrier concepts and give feedback. Overall, the author's ideas were well received. It is worth noting that it was discussed that these concepts are in their own category and should not be directly compared against one-handed solutions during evaluations.

The push plate would be an excellent simple solution and hopefully require little force to open, but it would need to be livestock-proofed.

The ground-operated and sequence-based ideas are the most blue-sky and innovative options and would be interesting to explore. More research would be needed into the viability of these solutions and bringing them to reality.

Simultaneous actions would be preferred over a sequence of actions as it would be easier for users. It would also be more livestock-proof as there is less potential for it to be left in a half-unlocked position.

The author felt that the Broughton Moor variant was the most promising and accessible solution. It would be easy to bring to life and straightforward for users. Many within the group agreed, and overall opinions on exploring adapting that gate were very positive. However, the team ultimately concluded that this concept would not be suitable as the users have to situate themselves significantly off the legal footpath to open it hands-free, which is also not viable in most situations as there is usually insufficient space around the path.

From this feedback, further development will focus on concepts that use simultaneous actions and operations to open and stay within the limits of the path.

3.3 INDUSTRY REVIEW EVENING

The Industry Review Evening provided the opportunity to present to, and get feedback from, a variety of industry professionals. A presentation board was made to present the research and initial ideas, and a physical model was created to aid with the visualisation of the concepts in 3D space (appendix H).

Due to workshop closures, a more rudimentary approach to initial modelling was taken using Meccano. It demonstrates how a bump gate can be integrated into a gate with the 2-way easy latch mechanism. The constraints of the Meccano limited further development of this model, and the next step would be to do CAD or physical modelling in workshops.

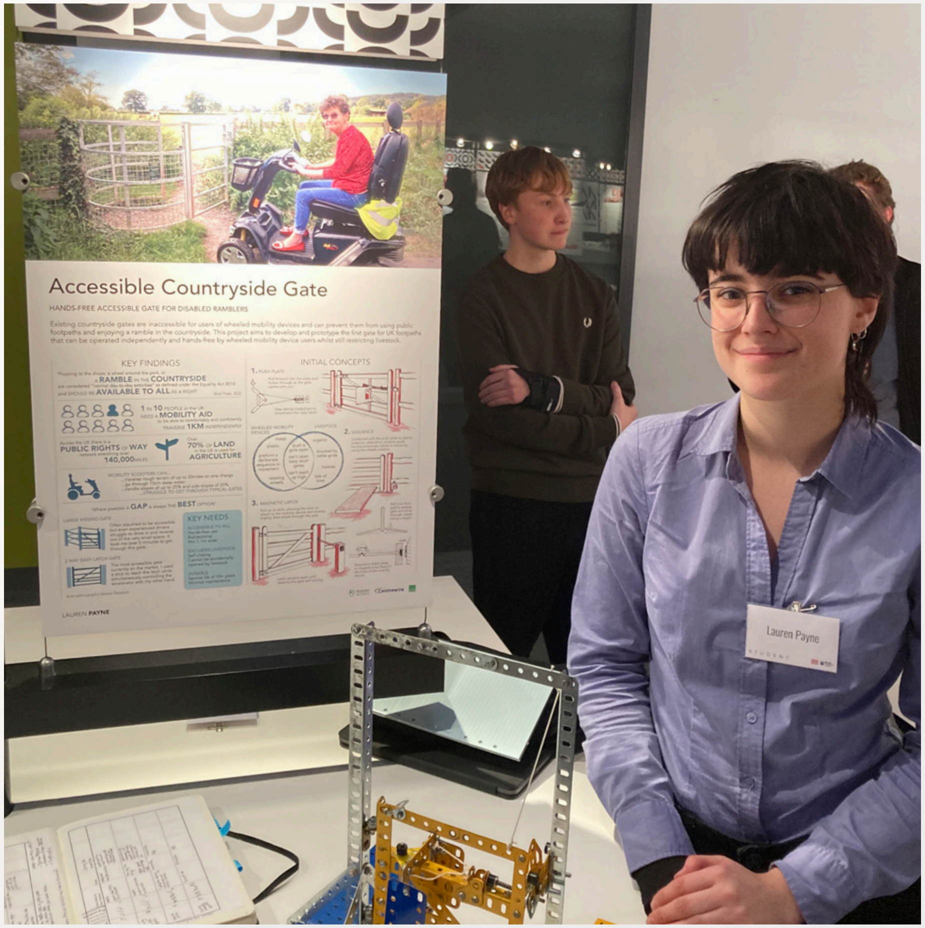

Accessible Countryside Gate
HANDS-FREE ACCESSIBLE GATE FOR DISABLED RAMBLERS
KEY FINDINGS
INITIAL CONCEPTS
Lauren Payne

Figure 22. Lauren Payne with her work at the Industry Review Evening

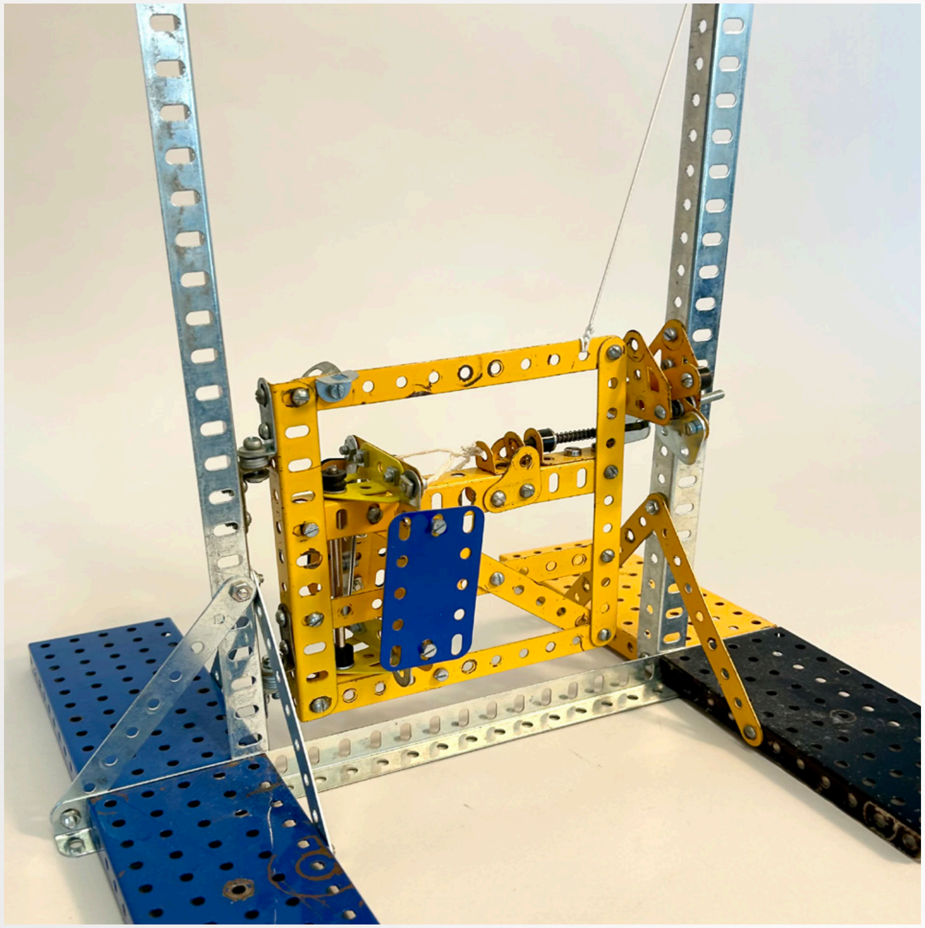


Figure 23. Initial Meccano Model

FEEDBACK FROM INDUSTRY

The overall response was positive, with feedback that it was well thought out and provided a comprehensive overview. Questions about the next steps were asked, and more physical modelling development was encouraged. Some wondered about using parallelograms to transfer force; another discussed fixing the latch up high, which could be opened via flagpole. It was also an excellent opportunity to speak to Tom Bindoff, the founder of Centrewire, one-on-one and discuss the logistics of developing a gate mechanism; he was pleased that it was compatible with the easy-latch. The other feedback was user-centred and mirrored the background research, which showed that it was essential to get the users involved throughout and that testing full-scale with the user group would be ideal.

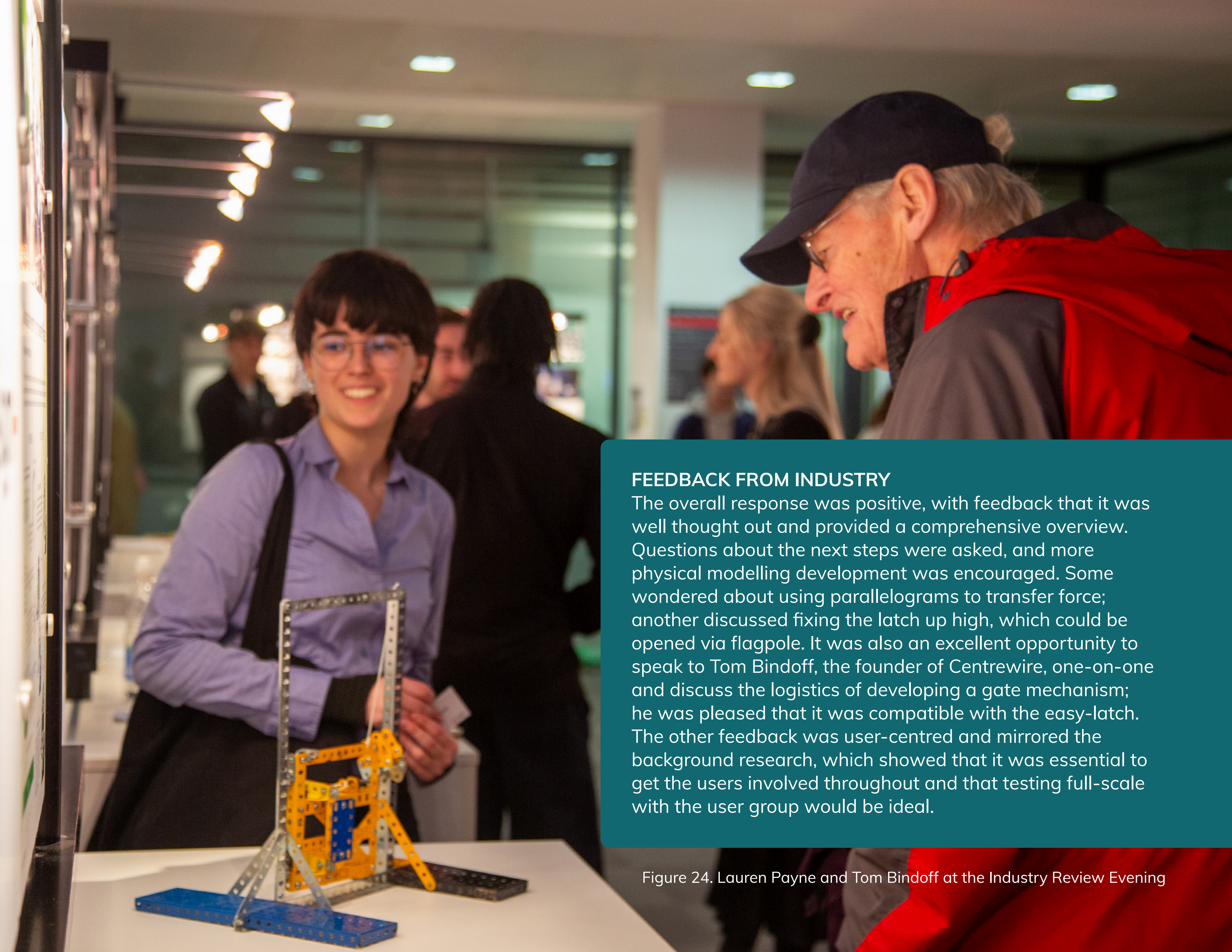


Figure 24. Lauren Payne and Tom Bindoff at the Industry Review Evening

3.4 CONCEPT IDEATION

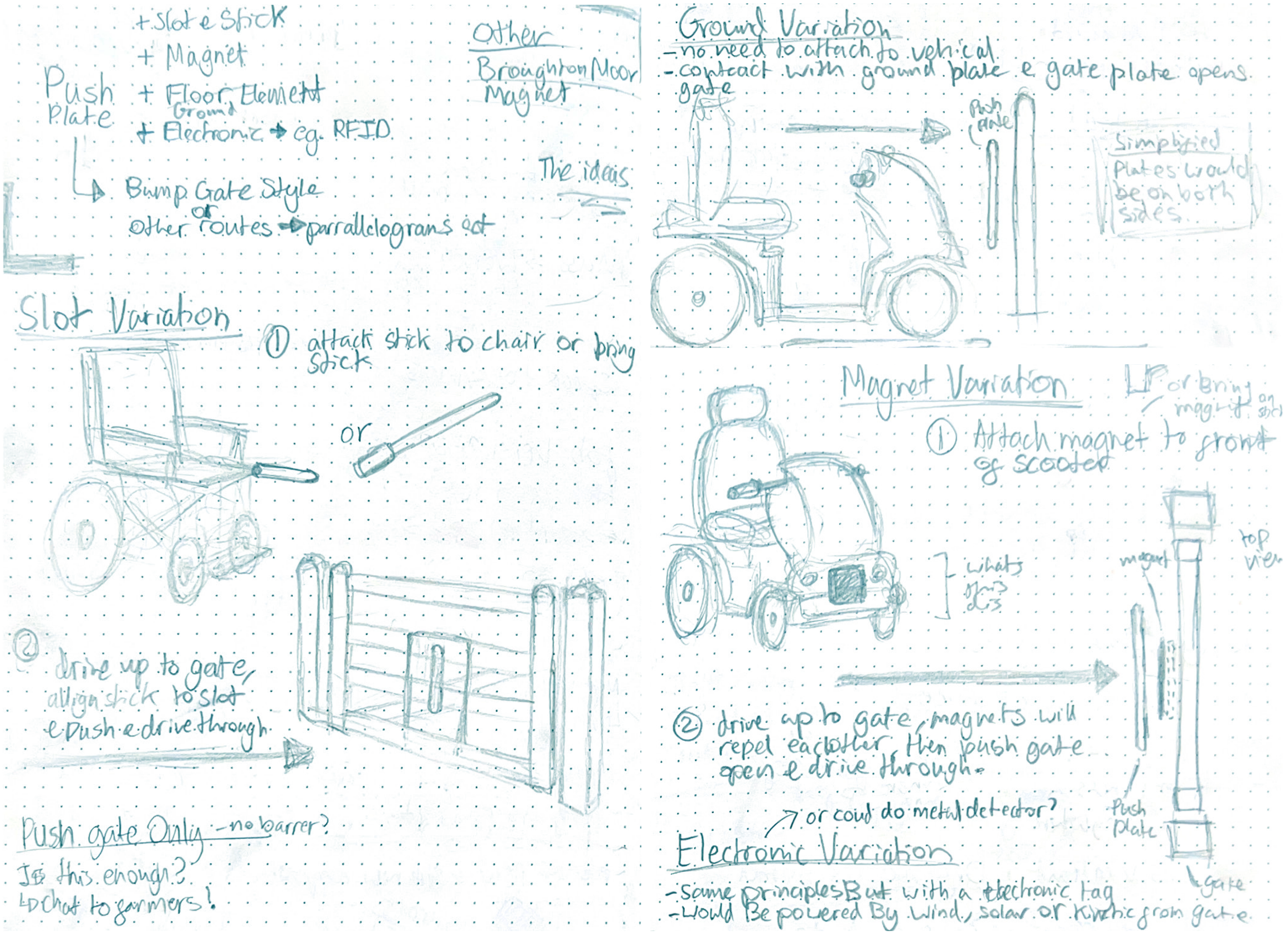
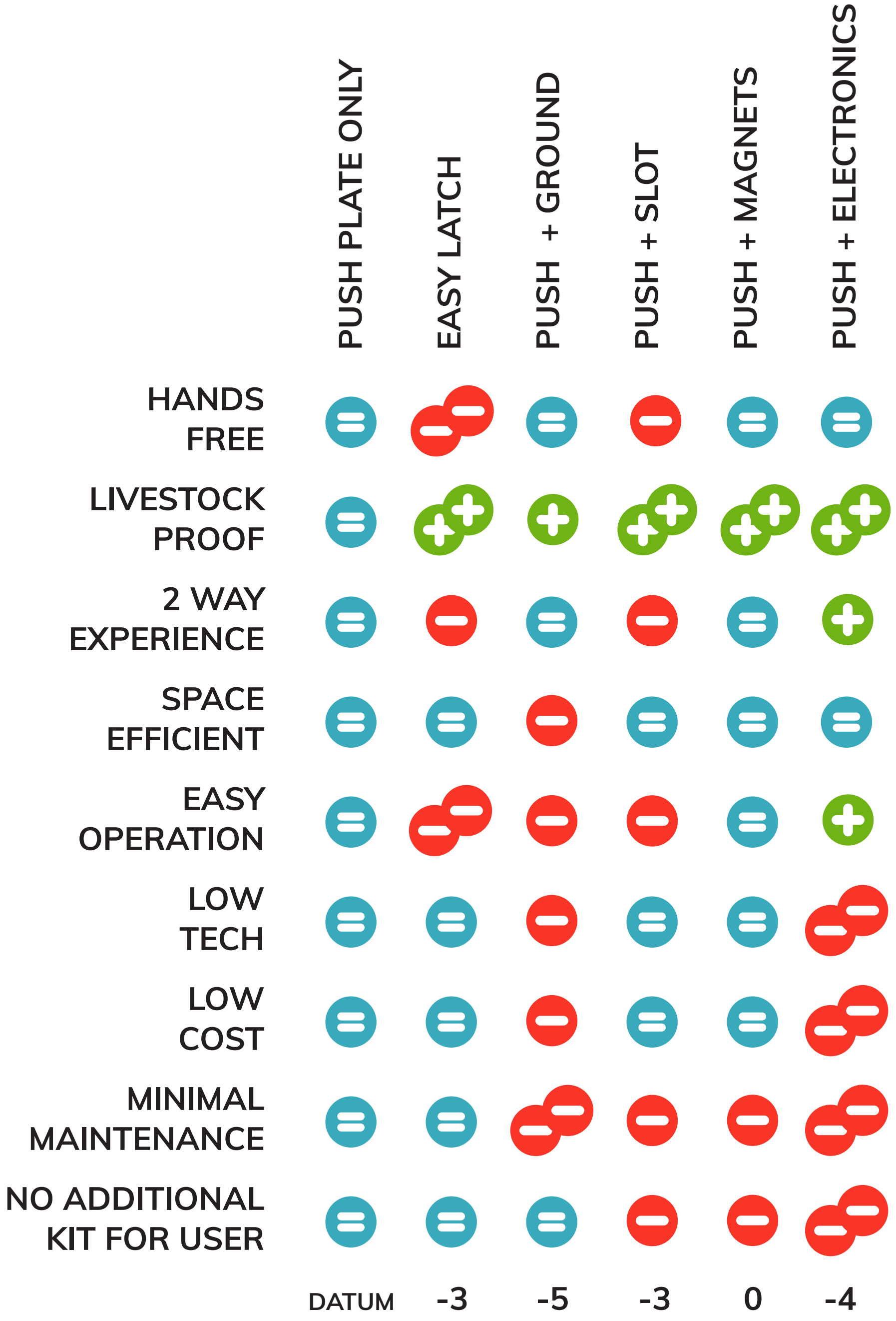

Push Plate
+ Slot e Stick
+ Magnet
+ Floor, Element
Ground
+ Electronic → eg. RFID
Bump Gate Style
or
other routes → parrallelograms ect
Other
Broughton Moor
Magnet
The ideas
Slot Variation
① attach stick to chair or bring stick
or
② drive up to gate, allign stick to slot e push e drive through.
Push gate Only - no barrer?
Is this enough?
Chat to farmers!
Ground Variation
- no need to attach to vehical
- contact with ground plate e gate plate opens gate
Push plate
Simplified
Plates would be on both sides.
Magnet Variation
or bring magnet on stick
① Attach magnet to front of scooter
whats there
magnet
top view
② drive up to gate, magnets will repel eachother, then push gate open e drive through.
Push plate
gate
or coud do metal detector?
Electronic Variation
- Same principles But with a electronic tag
- Would Be powered By wind, solar or kinetic from gate.

Figure 25. A rough sketch to illustrate all of the possible development routes for discussion with collaborative partner, Shail Patel.



	PUSH PLATE ONLY	EASY LATCH	PUSH + GROUND	PUSH + SLOT	PUSH + MAGNETS	PUSH + ELECTRONICS
HANDS FREE	=	− −	=	−	=	=
LIVESTOCK PROOF	=	+ +	+	+ +	+ +	+ +
2 WAY EXPERIENCE	=	−	=	−	=	+
SPACE EFFICIENT	=	=	−	=	=	=
EASY OPERATION	=	− −	−	−	=	+
LOW TECH	=	=	−	=	=	− −
LOW COST	=	=	−	=	=	− −
MINIMAL MAINTENANCE	=	=	− −	−	−	− −
NO ADDITIONAL KIT FOR USER	=	=	=	−	−	− −
	DATUM	-3	-5	-3	0	-4

Figure 26. Pugh analysis matrix of concepts

From the feedback, all options left on the table were explored. All hands-free and stockproof options require the user to carry something or attach it to the vehicle.

Pugh Analysis was used to evaluate these concepts against the datum of the bump gate; the easy latch gate was also included within the evaluation to provide context within the current market. Key attributes from the initial PRS (Appendix G) were drawn upon, with the most important attributes listed at the top.

None of the concepts ranked higher than the datum; however, this is not usable as it is not livestock-proof. The ground plate would be one of the more complex ideas, and with so many negatives, it is best to go with something simpler.

Setting the push plate behind a barrier with a slot in it that is opened with a stick is very feasible and would most likely be livestock-proof; however, it would require the use of a hand or aligning very precisely with a stick on the front of the vehicle which could also be a safety hazard.

Although the electronic route had the most positives, it also had the most negatives. It would require everyone who needs access to acquire and carry around a specific fob to enter. It would also need to be powered, which may be challenging in this context and require more maintenance. Solar and wind power both have challenges, as it is not always sunny or windy. Using energy generated from the gate closing may also be possible, but this would be minimal. The magnet idea still requires an attachment. However, it could be more flexible as any magnet or magnetic metal could open it. It would also be cheaper than electronics. Therefore, this will be the primary concept taken forward.

3.5 LANDOWNER INTERVIEWS

Interviews were conducted with farmers and land managers to gain insight into their opinions, perspectives, and knowledge. Also, it was to ensure that assumptions were not made about livestock behaviour, which is critical before further concept development is done.

FARMER 1
A dairy farmer who manages a farm with 200 acres, including around 75 dairy cows, 120 heifers, and 60 ewes with lambs

FARMER 2
A small holding owner in south Wales with around 20 acres of land. They currently keep mainly sheep and goats.

RESERVE MANAGER
A reserve manager for Natural England, responsible for managing several sites across Oxfordshire. They have over 150 sheep as a tool for land management and occasionally have ponies.

RIGHTS OF WAY INTERACTIONS AND ISSUES

The attitudes around rights of way were quite positive, especially compared to the perception of farmers that others had. However, there is the possibility of bias arising from the types of individuals interested in participating in these interviews. The main issues were walkers and dogs veering off the rights of way paths and gates being tied or propped open.

> “THE MAIN PROBLEM WE HAVE IS PEOPLE WALK THROUGH, NOT THE FOOTPATHS… AND THAT IS THEY WOULD TRY AND WALK TO OTHER PLACES AND JUST LEAVE THE GATES OPEN.” -F1

> “I THINK THE BIGGEST CHALLENGE PROBABLY COMES FROM DOG WALKERS, DOGS OFF-LEAD, DOGS DON’T STICK TO THE RIGHTS OF WAY” -RM

> “GENERALLY SPEAKING, RIGHTS OF WAY, PERFECTLY HAPPY WITH THEM. I THINK THAT THEY ARE AN ESSENTIAL PART OF THE COUNTRYSIDE” -F2

ANIMAL BEHAVIOUR

The participants highlighted the different behaviours that different animals display. Sheep will eventually find a hole in a fence line or gate and run away, whereas goats want to be around humans or find food and will jump and climb on anything to escape. Cows and bulls are much stronger, so they can apply more pressure to gates and barriers, especially when they rub their heads on them to scratch.

> “THE ONES THAT THE MAIN ISSUE IS SHEEP, EWES AND LAMBS. THEY WILL ESCAPE THROUGH ANYTHING” -F1

> “WHEN THEY RUB IT, OR THE BULL GOES UP AND RUBS IT, THEN THEY’RE VERY STRONG UNLESS IT’S WELL SECURED.” -F1

> “GOATS CAN BE A BIT OF PAIN BECAUSE THEY’RE ESCAPE ARTIST.. IF YOU’VE GOT ANY GATES OR ANY FENCES THAT ARE THAT ARE LOWER THAN, SAY, A ROUND ABOUT 3 1/2 TO 4 FEET, THEY CAN JUMP OVER THEM, CLIMB OVER THEM.” -F2

> “SHEEP ARE DIFFERENT. SHEEP WILL RUN AWAY ...AND IF A DOG GETS INTO THE FIELD, THEN YOU KNOW THAT COULD BE REALLY BAD FOR THEM BECAUSE THEY WILL RUN AND RUN AND RUN. THE DOG THINKS IT’S A GAME AND WILL CHASE THEM” -F2

> “CATTLE AND PONIES CAN BE A BIT MISCHIEVOUS WHEN IT COMES TO THE LONG HANDLES KIND OF RUBBING THEIR NOSES, RUBBING THEIR HEADS AGAINST IT.” -RM

DETERRENTS

Barbed wire, electric fences, and thick scrub are suitable deterrence methods for stopping animals from escaping, but none of them can be used around footpaths.

> “YOU DON’T REALLY WANT SCRUBBY, THORNY STUFF RIGHT NEAR A GATE WHERE HANDS AND STUFF ARE GOING TO BE?” -RM

> “THAT THERE’S NOTHING I’M AWARE OF THAT YOU COULD DETER THEM WITH. THAT WOULDN’T DETER EITHER THE PEOPLE OR THEIR DOGS OR WHEN THEY’RE WALKING THROUGH WITH.” -F1.

PURCHASE & INSTALLATION,

Self-closing gates are preferred, but they must be hung properly, or they will not self-close. Wooden gates are generally preferred for aesthetics but rot faster and need more maintenance. Surprisingly, both farmers spoke of their councils paying for gates to be replaced, and they only had to do maintenance. The councils often did this to install 'better gates' such as kissing gates.

"FOR US, THAT SELF-CLOSING GATE IS BETTER" -RM

'WOODEN GATES ARE PREFERABLE, BUT I FIND A NICE COMPROMISE AS YOU CAN GET THE METAL H FRAME, BUT THE GATE ITSELF CAN BE WOODEN." -RM "

"WE'VE GOT A VERY GOOD COUNCIL, AND IF THEY'RE BROKEN, THE COUNCIL WILL BASICALLY GIVE US THE GATE AND WE WILL THEN PUT IT UP." -F1

"WE NORMALLY GET OUR TIMBER JUST FROM A LOCAL SUPPLIER, WHEREAS FOR THE GATES, WE GO TO SOMEONE MORE SPECIALIST LIKE IAE" -RM.

MAINTENANCE & LIFETIME

Gates typically last around 10-20 years, depending on the material. Overall, they need minimal maintenance, but it can sometimes be expensive if specialist equipment needs to be rented to fix them.

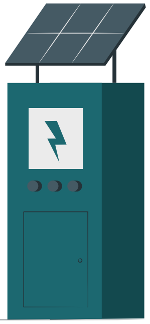
"YOU KNOW, UNLESS THEY'RE BROKEN, WE DON'T TOUCH THEM." -F1

"IF YOU DON'T HAVE ALL THE EQUIPMENT TO DO IT, WHICH I DON'T HAVE THINGS LIKE POST KNOCKERS, ...I USUALLY PAY FOR A CONTRACTOR TO COME AND DO IT, WHICH THEN THAT IS A COST INVOLVED IN IT" -F2

"SO WE CARRY OUT SIX-MONTHLY INSPECTIONS... THE MAIN CAUSE OF MAINTENANCE ISSUES IS JUST NATURAL ROTTING OF THE POSTS." -RM

"WELL, THESE DAYS, FENCE POSTS LAST LESS THAN 10 YEARS. THEY, I THINK THERE WAS LEGISLATION THAT REMOVED A CERTAIN CHEMICAL... SO THEY ROTTED QUICKER THAN THEY USED TO" -F2

"I WOULD EXPECT 20 YEARS FOR A GALVANISED GATE TO LAST" -F2



ELECTRONICS

Powering electronics is possible but not always reliable, especially in the winter when solar energy cannot be utilised, and people would prefer not to use electronics. There were also concerns about tampering and theft if the components were valuable; this would also make the gate more expensive.

"WE HAVE USED ELECTRIC FENCE THE PAST TO AID WITH GRAZING, BUT WE'D ONLY DO THAT THIS SUMMER WHEN THERE'S ENOUGH LIGHT TO KEEP THE BATTERIES CHARGED FOR THE SOLAR." -F2

"NO, AS LONG AS THERE IS A WAY OF MAINTAINING THE POWER ON IT, HOW WOULD THAT HAPPEN?" -F1

"IF THE ELECTRICS ARE VALUABLE AND IF THEY'RE OBVIOUS, IF THAT KIND OF MAKES THAT STRUCTURE MORE PRONE TO BE TAKEN" -RM

MAGNETS

With magnets, the risk of cows' metal ear tags or people wearing jewellery getting attached to them is possible but unlikely but should be considered. Additionally, it's critical to ensure they can withstand the outdoor conditions.

"NOT REALLY. I CAN'T SEE A PROBLEM WITH MAGNETS; IT WILL GIVE YOU MORE STRENGTH." -F1.

"RUST AND THE GATE MIGHT SORT OF REDUCE THE EFFECT OF THE MAGNET" -F2

"WELL, THEY HAVE EAR TAGS, AND THEY BE METAL, SO THE YOU KNOW, NOT ON MOST OF, SOME THEY DO" -F1

"I GUESS IF SOMEONE'S WEARING SOMETHING AND HOW STRONG THAT PULL IS, LIKE IF THEY'VE GOT A RING OR A BRACELET OR SOMETHING" -RM.

These interviews showed that ensuring the barrier blocks a range of animals is crucial to its success. They provided confirmation that using electronics would not be ideal for a footpath gate due to struggles with consistent power, higher costs, maintenance issues and increased risk of theft. Unfortunately, no magic solutions that could deter all animals and were safe for use on footpaths were found. They also seem unconcerned about magnets overall, so exploring magnets is now the primary direction of interest for the project. This also means looking at permanent magnets, not electromagnets on the gate, although the magnet on the vehicles could be an electromagnet.

3.6 MAGNET VIABILITY

SAFETY
A magnet of up to 3000 Gauss is safe for handling (Stanford, 2024). For individuals with pacemakers, the safe distance from a magnet is generally suggested to be 15cm+ (this is when the field is less than 5 Gauss, so for stronger magnets, it needs to be further away). Issues may arise if the magnet is fixed around chest height on the gate; putting it lower on the gate should help resolve this. No specific laws exist on the use of magnets relating to pacemakers; however, it is strongly advised that magnets should be labelled (Shen, 2023).

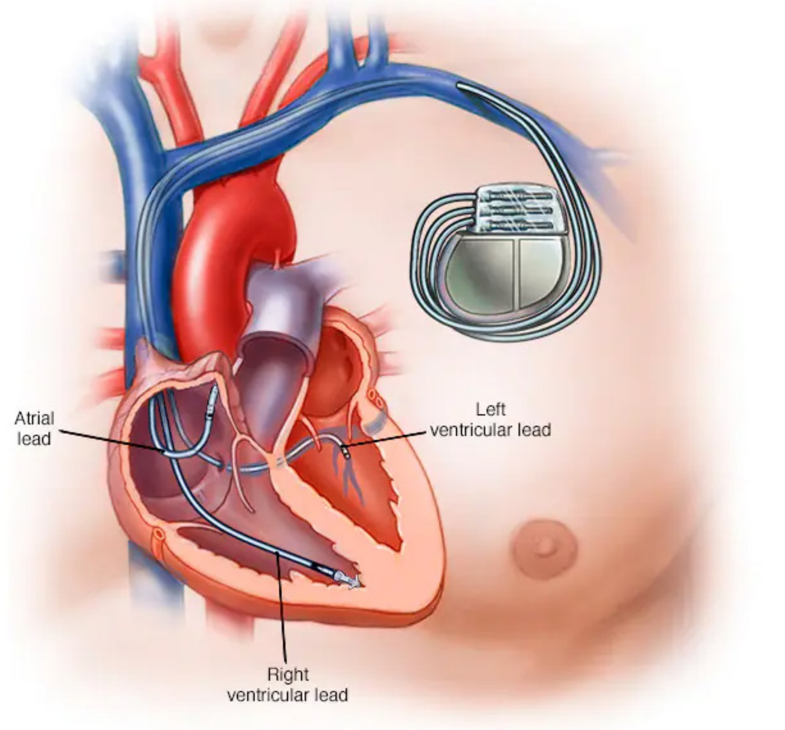


Figure 27. Pacemaker diagram (Mayo Clinic, 2023)

DEMAGNETIZATION
Causes of Demagnetisation:
- Extreme heat or cold exposure (well outside of the natural outdoor temperature range in the UK)
- Shocks and Vibrations
- Corrosion and oxidation
- External magnetic fields
- Electric current

Modern permanent magnets will not typically be damaged by cold weather or impact, provided the magnet does not physically break, crack or corrode (Ward, 2020).

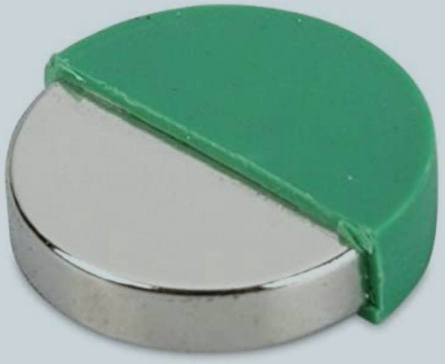


Figure 28. Coated neodymium magnet (magnosphere, 2023)

EXPERT CONSULTATION
Eclipse magnets were consulted for advice on using magnets outdoors. They advised to use ferrite magnets or if using neodymium magnets to ensure they are coated in plastic to avoid corrosion.

3.7 MATERIALS

Centrewire (part of IAE) makes and sells both galvanised steel and treated pine gates (Centrewire, 2023). Timber gates are more popular and would also be more suitable for use with magnets, as galvanised steel is a ferrous metal and would interfere with them. The fixings, including the bolt, latch and hinges on the timber gates, are still galvanised steel.

EXPERT INSIGHT
Insight from Centrewire. The metal gates last longer and require less maintenance, so they can be cheaper and require less effort in the long term. The general opinion, especially from countryside enthusiasts and conservationists, is that timber is preferable, especially for its ‘natural aesthetics’. Timber tends not to visually disrupt the landscape the way a metal gate would, so these gates are overall more popular.

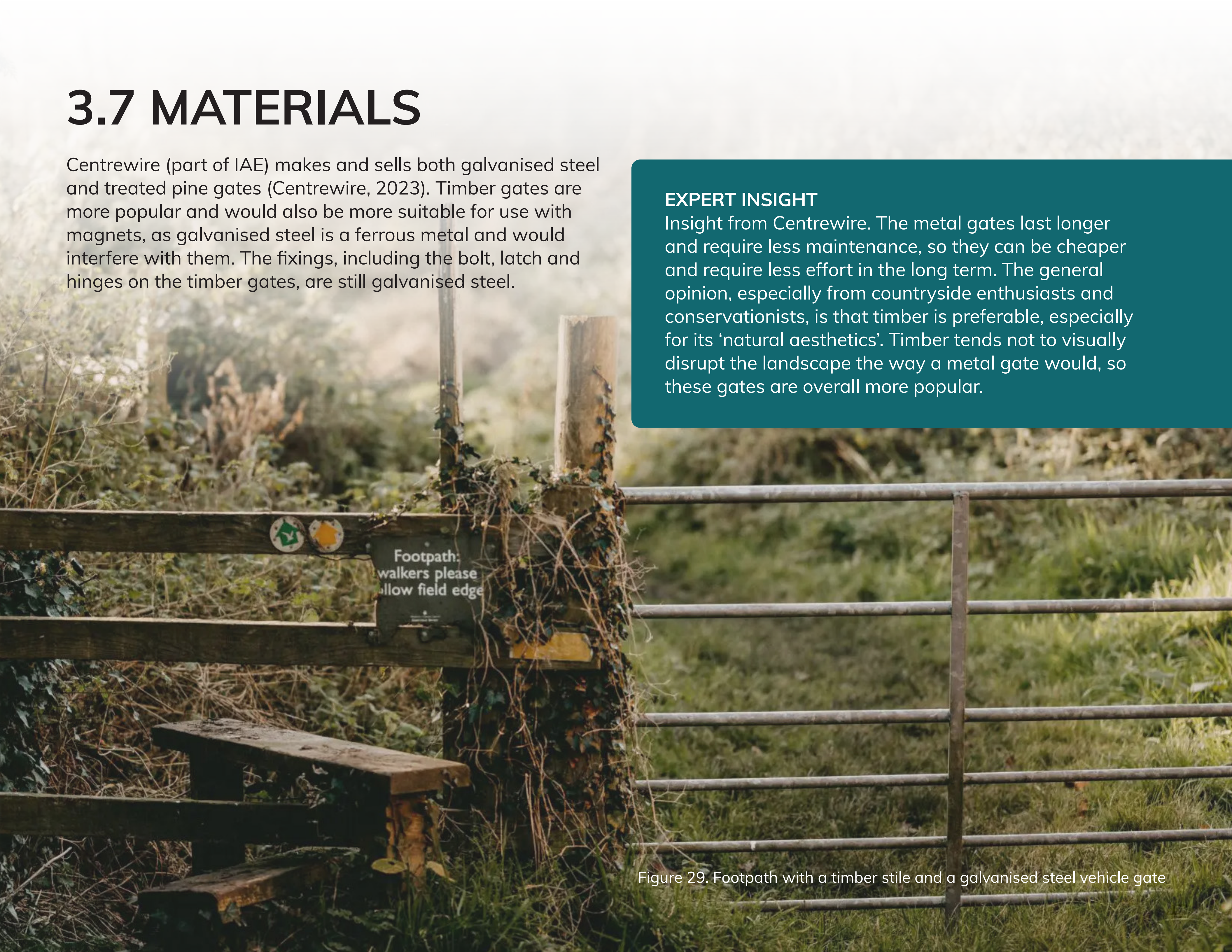
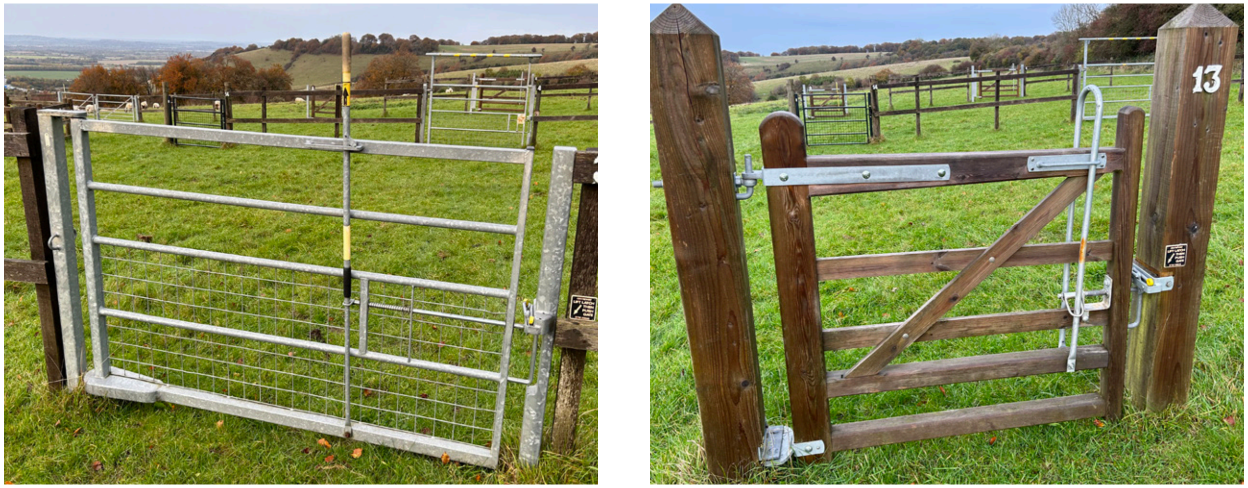


Figure 29. Footpath with a timber stile and a galvanised steel vehicle gate

3.8 ECONOMIC VIABILITY

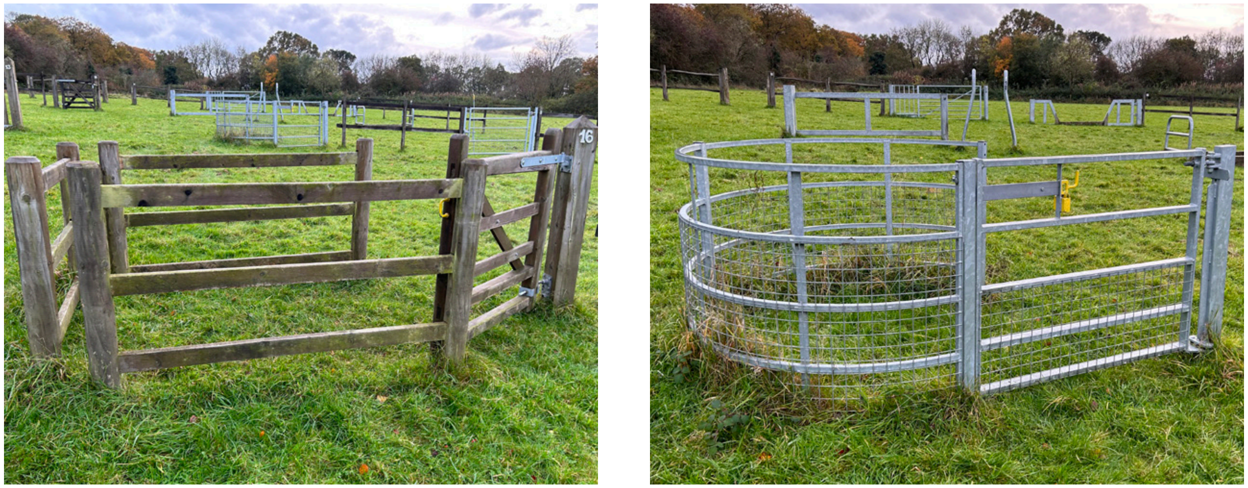
Not only should the gate be physically accessible, but it should also be financially accessible. It may be able to benefit from governmental grants and subsidies from local councils but should still aim to be economically viable on its own merit. Using standard parts where possible and ensuring they work with currently used gates will help to keep costs down. Avoiding the use of electronics will also help keep costs low.

The gates that are designed for accessibility, although not that fit for purpose, still cost around double the price of the easy latch gates. If the gate can be kept within this range, it should be economically feasible.



2-WAY GALVANISED STEEL EASY LATCH GATE: £298.00

2-WAY TIMBER EASY LATCH GATE: £356.00



LARGE OXFORD KISSING GATE: £403.00

LARGE MOBILITY KISSING GATE WITH RADAR LATCH SYSTEM: £620.00

Figure 30. Centrewire UK footpath gates and their prices

4 DEVELOP

4.1 MECHANISM DEVELOPMENT

Accurate modelling was needed to move into reality and replace the Meccano model. Initially, a 1:4 scale mock-up of the 2-way easy latch Centrewire gate leaf was started in the workshops, which were derived from technical drawings provided by Centrewire. It quickly became apparent that it would be inefficient time and materials-wise to model physically and at this scale right away. Therefore, modelling was moved over to CAD, which can be more easily manipulated, iterated and replicated.

A simplified gate was modelled on fusion, at full scale, to allow for visualisation of the product against relevant environmental elements such as paths and livestock and to print at different scales according to need. Additionally, a quick mock-up of the Tramper Scooter was made for added context.

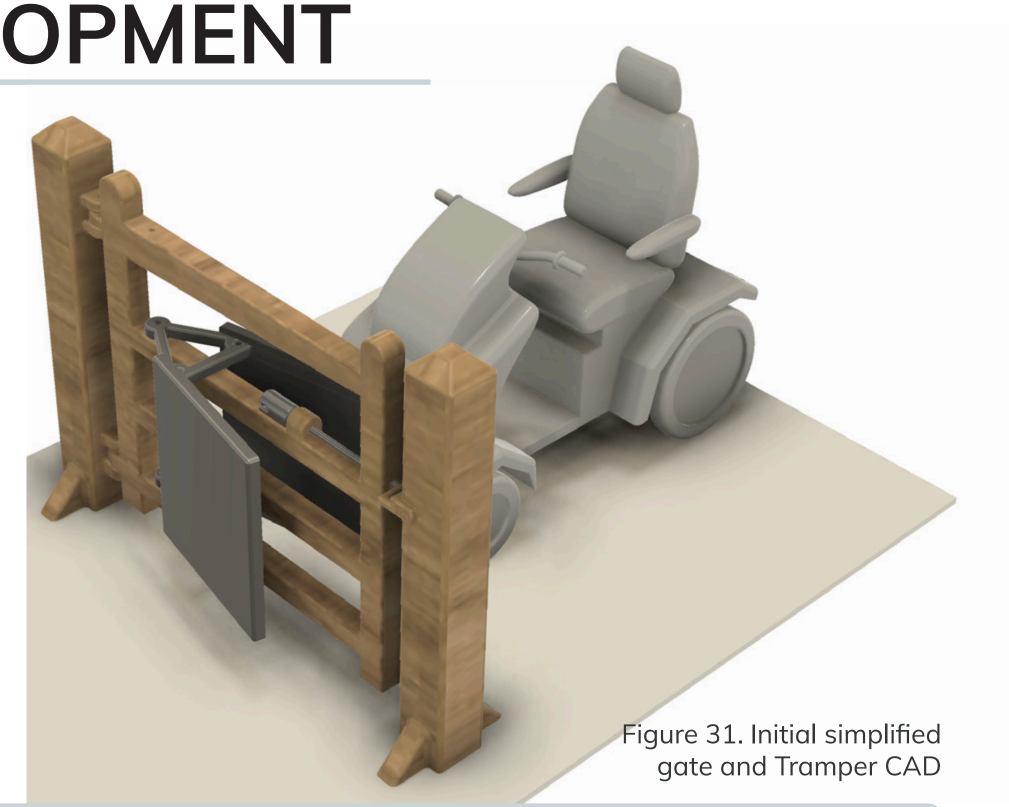
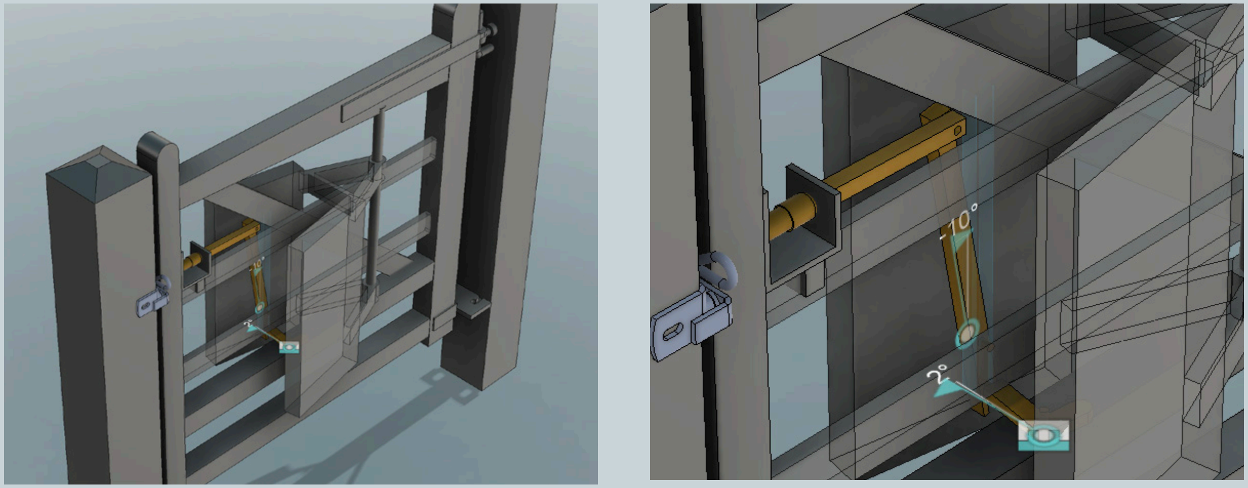


Figure 31. Initial simplified gate and Tramper CAD



EXPERT INPUT

Using a mechanism supplied by Steve Slade was explored; however, it would need more force and had more moving parts, likely needing more maintenance. Therefore, the bump gate style mechanism was brought forward.

Figure 32. Developmental CAD of a Centrewire gate combined with Steve's mechanism

The models were printed at 1:8 scale for rapid prototyping and with ample space to test with vehicles. Conscious of not making the mechanism too bulky, the profile was kept slim. However, with the first test, the movement of the plates was not large enough to release the bolt from the catch. After further iteration of the angle, it started working consistently.

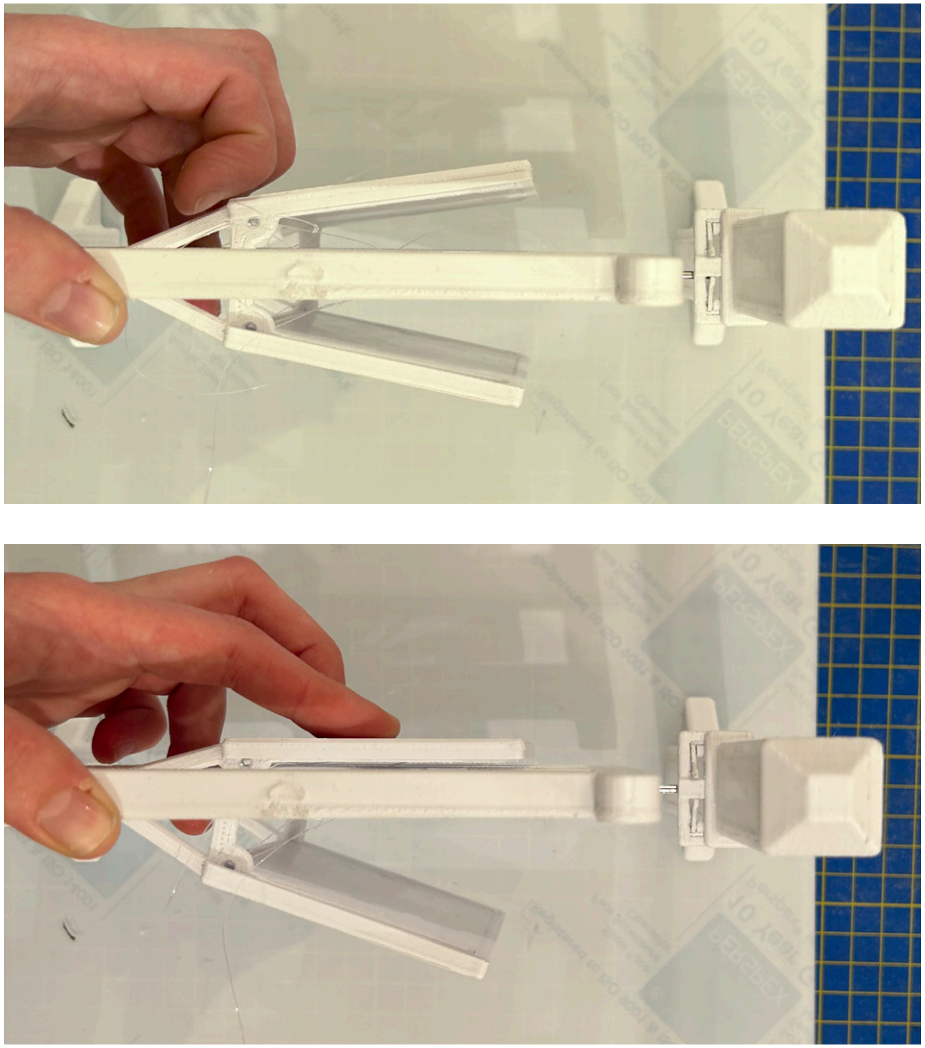


Figure 33. Narrow push plate model

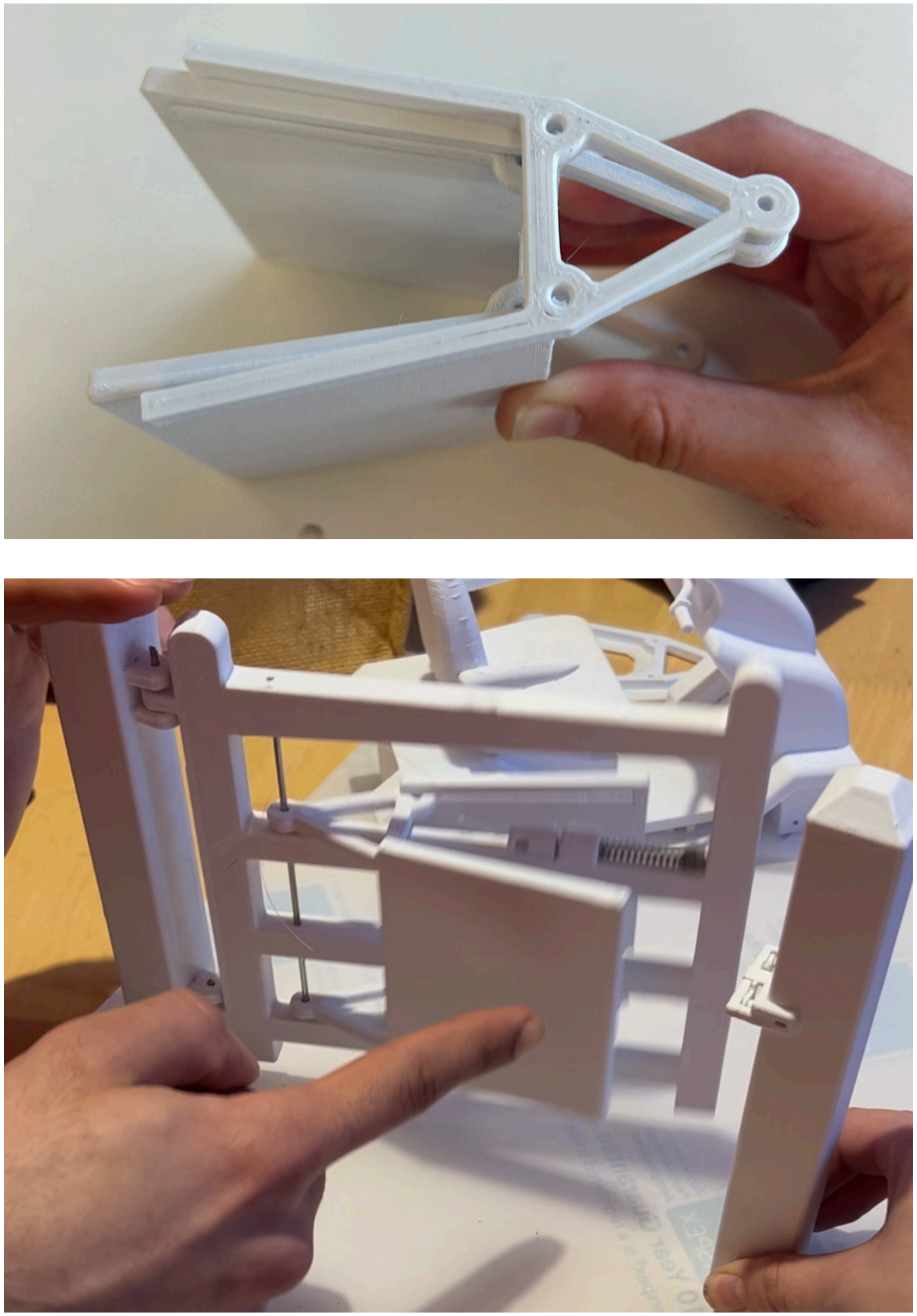


Figure 34. Modified push plate model that can clear the latch

4.2 PRODUCT DESIGN SPECIFICATION

1. PERFORMANCE

1.1 The product must be independently operable by wheeled mobility aid users
1.2 The product must restrict livestock
1.3 The product must be on par with existing products in its usability by other walkers
1.4 The product must operate and open in both directions
1.5 The product must self-close
1.6 The product should stay open long enough for a wheeled mobility aid user to get through
1.7 The product should work with a range of wheeled mobility devices
1.8 The product should be a low-tech solution (e.g. not powered)
1.9 The product may be usable by horse riders

2 ERGONOMICS

2.1 The product must operate hands-free without the need for users to stand up
2.2 The product must be easy to use with minimal physical exertion from the user
2.3 The concept must be functional at full-scale
2.4 The gap between must be a minimum of 1.1m wide to accommodate wheeled mobility aid users, but it could be wider
2.5 The product should be intuitive to use without additional training

3 AESTHETICS

3.1 Touchpoints must clear to users and may be yellow
3.2 The product aesthetics should align with existing countryside gates

4 MATERIALS

4.1 The product must be primarily made of Treated Softwood Timber and/or Galvanised Mild Steel
4.2 The product must be durable
4.3 The product must not use materials or substances that could leach into the environment or cause danger to animals

5 ENVIRONMENT OF USE

5.1 The product must be weatherproof and suitable for permanent outdoor exposure
5.2 The product should perform in the temperature range -15C to 35C
5.3 The product must not disrupt the aesthetics of the countryside environment
5.4 The product must be compatible with existing fences and paths
5.5 The product should withstand the shock of the gate closing

6 SERVICE LIFE

6.1 The product must last a minimum of 10 years but should last 15-25 years (current gate lifespans 10-25 years)

7 MAINTENANCE

7.1 The product should require minimal additional maintenance within its service life compared to existing gates.
7.2 The product should be deconstructable to allow for replacement of individual components or modules

8 MANUFACTURING

8.1 The product should be suitable for batch production
8.2 The product must be suitable for manufacturing in the UK to reduce travel emissions
8.3 The product should aim to use minimal additional tech to keep manufacturing costs down
8.4 The product should use standard components and current manufacturing techniques where possible to reduce additional costs
8.5 The final manufacturing cost should not exceed 3x the cost to produce other gates

9 MARKET

9.1 The product designed is for disabled ramblers with mobility issues and must be suitable for wheeled mobility aid users in the UK
9.2 The product should be suitable to be pitched to Centrewire for manufacturing
9.3 The product would be distributed to Natural England and other Landowners.
9.4 The product should cost no more than 2x higher-end gates to purchase
9.5 The product could be subsidised by charities and local councils

10 QUALITY AND RELIABILITY

10.1 The product must consistently work every time
10.2 The product should be able to withstand high wind, interest from animals and tampering from walkers, such as hanging on the frame
10.3 The tolerances should allow for the compression and expansion of metal and wood throughout the seasons
10.4 Any fragile components should be cased to avoid damage

11 STANDARDS & LEGAL REQUIREMENTS

11.1 The product must not obstruct legal users of the rights of way
11.2 The product must comply with BS5709:2018 (British Standard for Gaps Gates and Stiles)

12 INSTALLATION

12.1 The product must be suitable for installation using standard equipment without additional training

4.3 MAGNET EXPLORATION

EXISTING MECHANISMS

With the challenge of having two simultaneous actions at once, a natural place to look was child locks. Typical child locks where two simultaneous motions are performed, for example, the lid is pushed and twisted, would not translate well to this situation; however, magnetic child locks could work well; it uses the attraction of 2 magnets to unlock a latch. The concerns would be that the strength of magnets needed would not be suitable when scaled up. Other magnetic locks and latches exist such as door locks (Brian and Looper, 2011); however, these tend to use electromagnets.

MAGNETIC INTERACTIONS

Magnets have a north and south pole and create a magnetic field. They interact with each other in two main ways: attraction (when two poles unlike poles meet) and repulsion (when two like poles meet). These can be used to create a secondary latch within the gate.

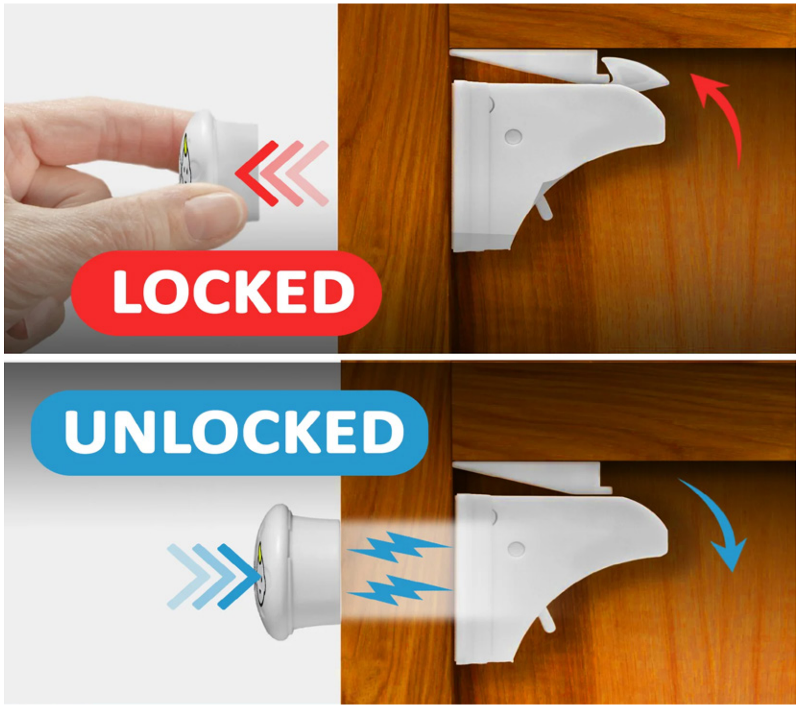
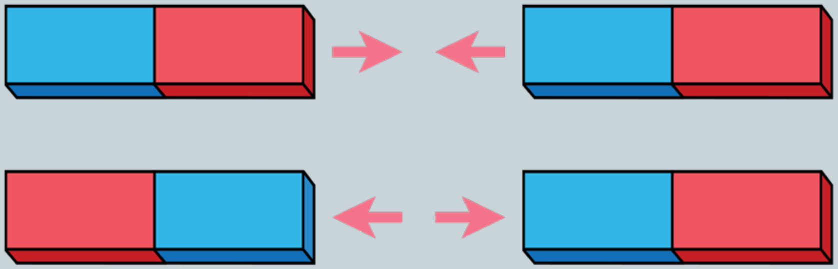


Figure 35. Magnetic cabinet child lock mechanism (Jool, 2024)



ATTRACT

Advantage - Only needs one magnet

Disadvantage - Passive open, could be held open with metal

REPEL

Advantage - Active open, only open while in range of the second magnet

Disadvantage - Needs two magnets

4.4 CONCEPT DEVELOPMENT

A secondary latch for the gate was developed using repelling magnets (one on the vehicle and one within the gate) and utilising the pivot-style latch found within the cabinet child locks. This latch is a blocker that restricts the push plate from being pushed. Using the magnet in this way means that a lower-strength magnet can be used as the force needed is small compared to the force needed to remove the bolt from the latch, which is done by utilising the force of the driving vehicle.

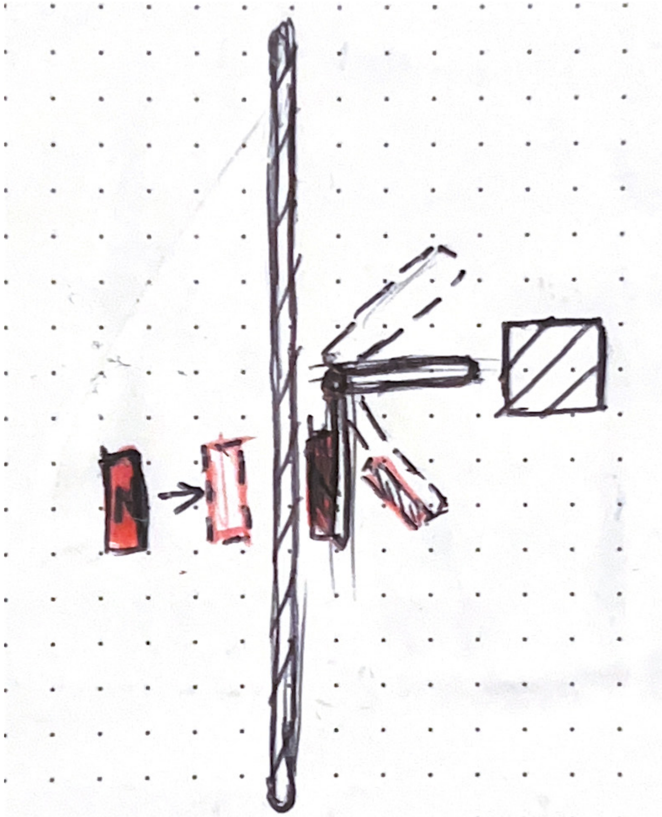


Figure 36. Mechanism sketch

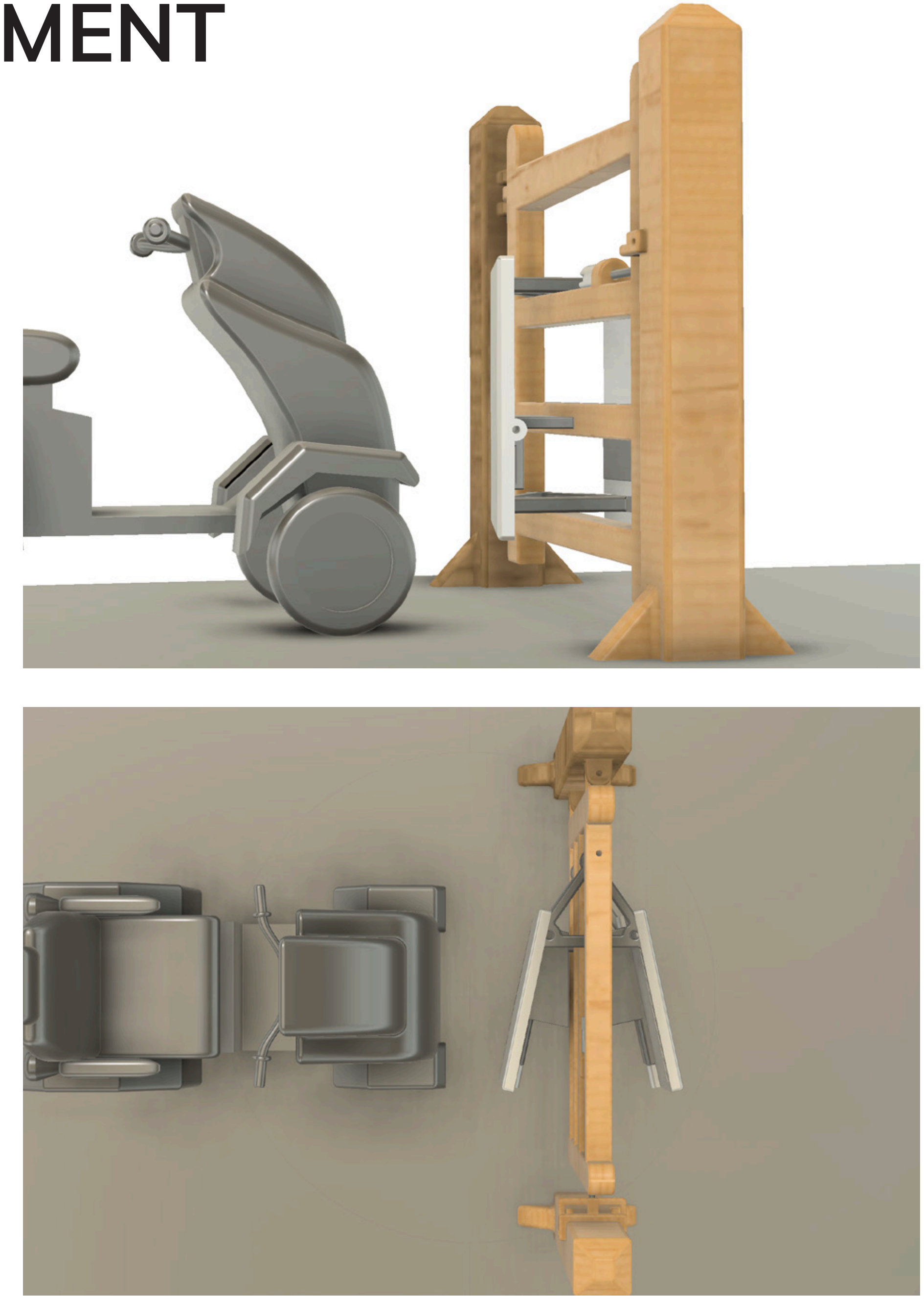


Figure 37. Mechanism CAD

4.5 PHYSICAL PROTOTYPING

VERSION 1
This model demonstrates how the magnet in the gate repels and pivots the blocker out of the way when the other magnet is in range.

The blocker was too short, allowing the plate to be partially pushed. It also had a small surface area on the end, and this, combined with the magnet altering its centre of gravity, meant that the plate could be pushed without a magnet. Adding this mechanism on the inside of the push plate made it bulkier and reduced its travel distance, causing the bolt not to release from the latch fully.

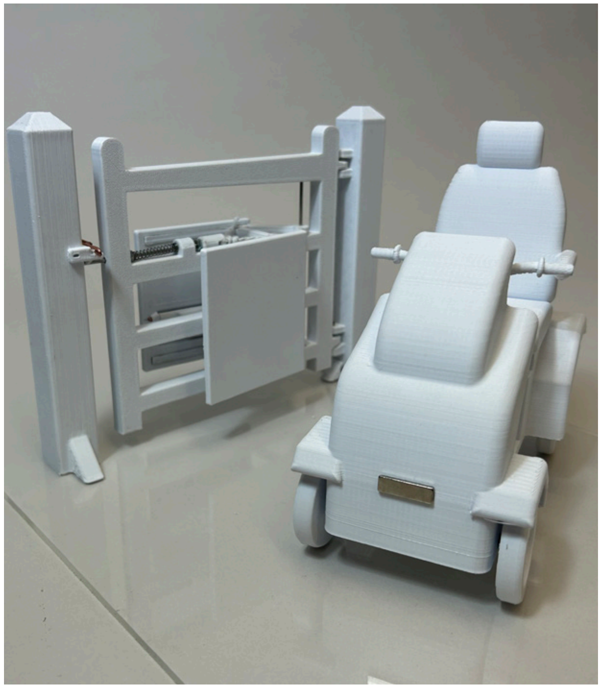


Figure 38. Version 1 gate prototype and Tramper scooter model

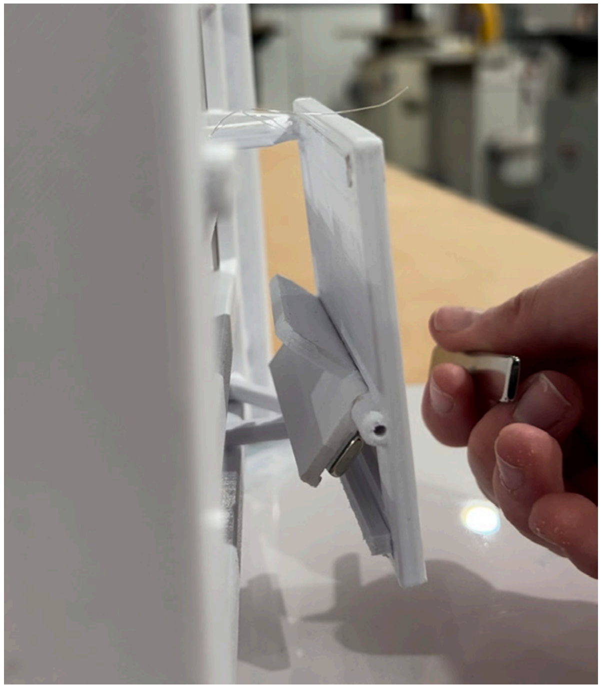


Figure 39. Blocker pivots out the way when the magnet is in range

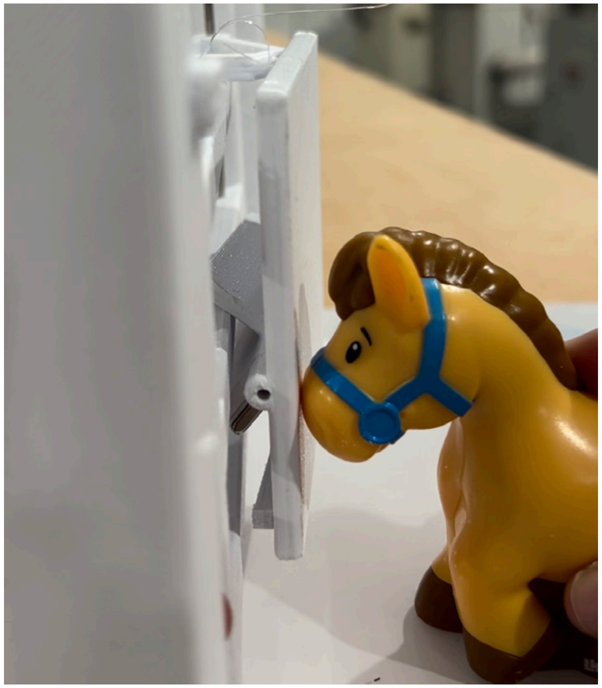


Figure 40. Blocker unfortunately slips passed when pressure is applied to the plate

VERSION 2

Moving the plates further from the gate leaf allows for more travel distance and the bolt to clear the latch. The plates were also laid out further parallel to the gate leaf frame to indicate better how the gate should be used and make the direction of the force of the blocker perpendicular to the gate to reduce stresses. The magnets were also swapped out for smaller, weaker magnets as the initial ones used were excessive at the scale, and small magnets still provided ample strength. A larger end was also added to the blocker to stop it from being able to be bumped open. The author opted for twine, which kept it more rigid as the fishing wire was prone to slipping.

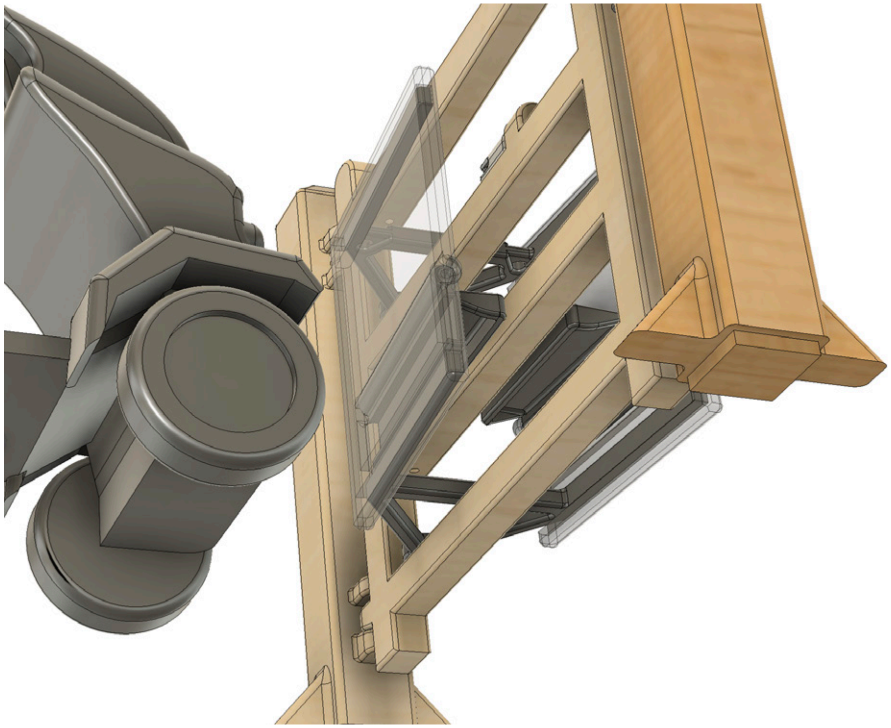
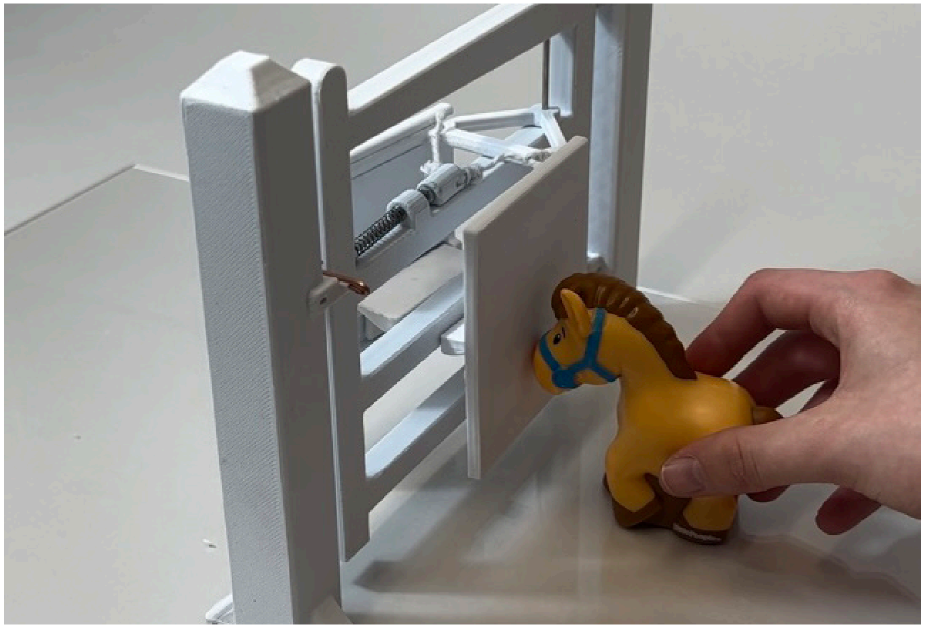


Figure 41. Version 2 push plate and blocker mechanism CAD



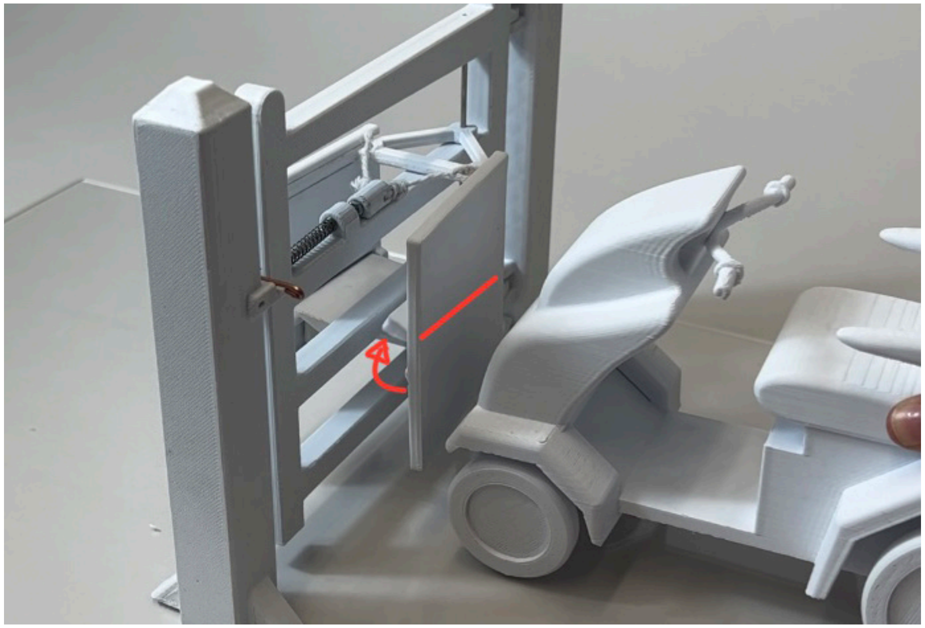


Figure 42. Version 2 gate prototype the blocker stops the livestock pushing the plate but pivots out of the way for the vehicle

The small scale of this model limited its ability to be translated to full scale. The printed components were also quite brittle and prone to breaking and could easily be pushed out of alignment, allowing the bolt to slip past or miss the latch entirely. Also, the force needed to open it is comparatively higher compared to the component's strength. Additionally, detailed development at such a small scale is complex due to the different tolerances and weights. Further prototyping will be done at 1:4 scale; full-scale testing may be needed for the magnets.

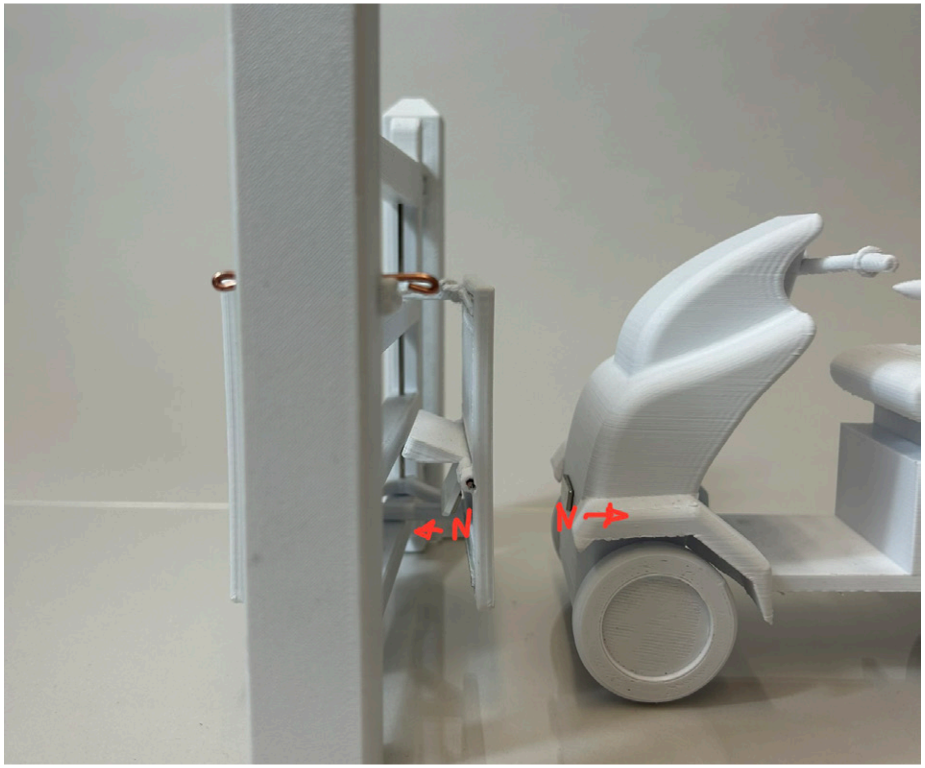


Figure 43. Version 2 side view showing repulsion of the magnets

CONFERENCE FEEDBACK

Feedback from the Accessible Gates Workshop was overall positive, and they were happy to see physical prototyping as it was helpful for understanding the mechanism. They were pleased with the solution, which did not need electronics.

Further testing of magnets at a significant scale is critical, and it is important to ensure they will not corrode. There are concerns that magnets may need to be very strong, especially if they need to be coated in a plastic casing.

Centrewire's main comment was that exploring the material for the push plates that balance strength and thickness should be the next step. Also, the panel on the front is very big and, therefore, would be an expensive component, whatever material it is made from. It may be worth considering if a standard part or an existing component could be used for this.

A representative from Natural England highlighted that lambs may be able to get trapped between the plates. She suggested covering the end of the plates to block the gap or reducing it to a maximum of 6 inches to reduce this risk.

Some more consideration is needed regarding how the magnet would be attached to the Tramper and how it would work with powerchairs.

4.6 USER CONCEPT EVALUATION

Online semi-structured interviews were conducted with users to evaluate the concept. The users were interested in and excited about the concept overall and were happy to see a non-electronic solution. More details can be found in Appendix F

Some users are concerned about how it would work with their vehicles. Participant 3 had concerns about the magnet possibly interfering with the battery if it was fixed directly to the front of the scooter and also had concerns about the plate possibly causing damage to the vehicle.

Participant 5 has significant upper body mobility and uses a Tri-ride. They thought it was a good idea for mobility scooter users but would not work for them personally and were concerned that it created an additional barrier by requiring a magnet. However, once it was understood that the easy latch would still work, they were on board with the concept as they could still use that latch if preferred.

"A MAGNETIC CATCH IS A GOOD IDEA PROVIDING IT DOESN'T NEED A LOT OF FORCE, THAT'S GRAND"

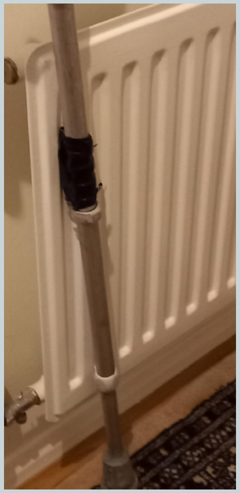
- Participant 1

"IT HIGHLIGHTS THE DIFFERENT NEEDS PEOPLE HAVE. I WOULD FIND IT ANNOYING BECAUSE I'M NOT GOING TO GO UP AND PUSH WITH MY FEET. WHERE WOULD THE MAGNET BE ON THE MOUNTAIN TRIKE? IT'S TOO MANY THINGS GOING ON."

"I'M BEHOLDEN ON HAVING A MAGNET AND SO ONE'S ALREADY CREATING ANOTHER BARRIER."

- Participant 5

Participant 4 thought the concept would work great for him as a member of Disabled Ramblers. He even currently has a walking stick with a magnet attachment that he often uses to help him open cupboards and reach things, which he would be interested in using to open the gate.



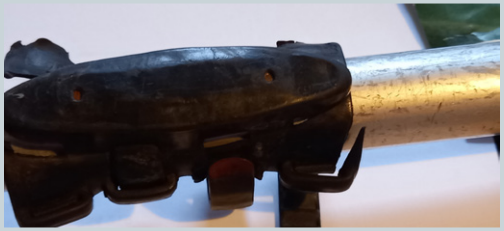


Figure 44. Participant 4's walking sticks with attached magnets

4.7 VEHICLE ATTACHMENT IDEATION

The Tramper Scooter CAD was developed into a more detailed version that included the bull bar, which the magnetic attachment could be fixed to without potentially interfering with the batteries. Initially, the magnet was designed to sit above the top bar but was changed to hanging below so it would not have to work against gravity and would not be as easily knocked. A concern is that the hard material of the attachment would be the first part to hit the plate and would get damaged quickly, so this will need to be further developed.

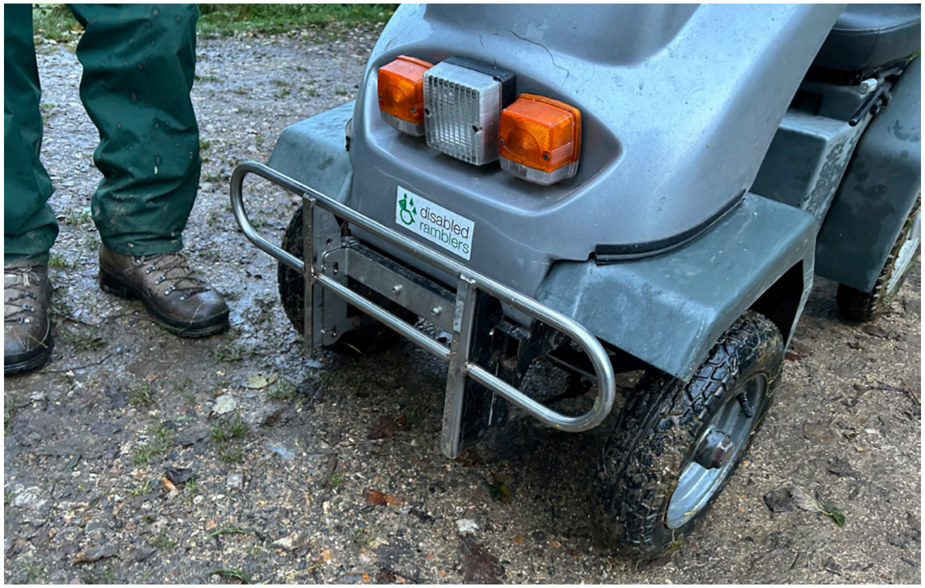


Figure 45. Tramper scooter with bull bar

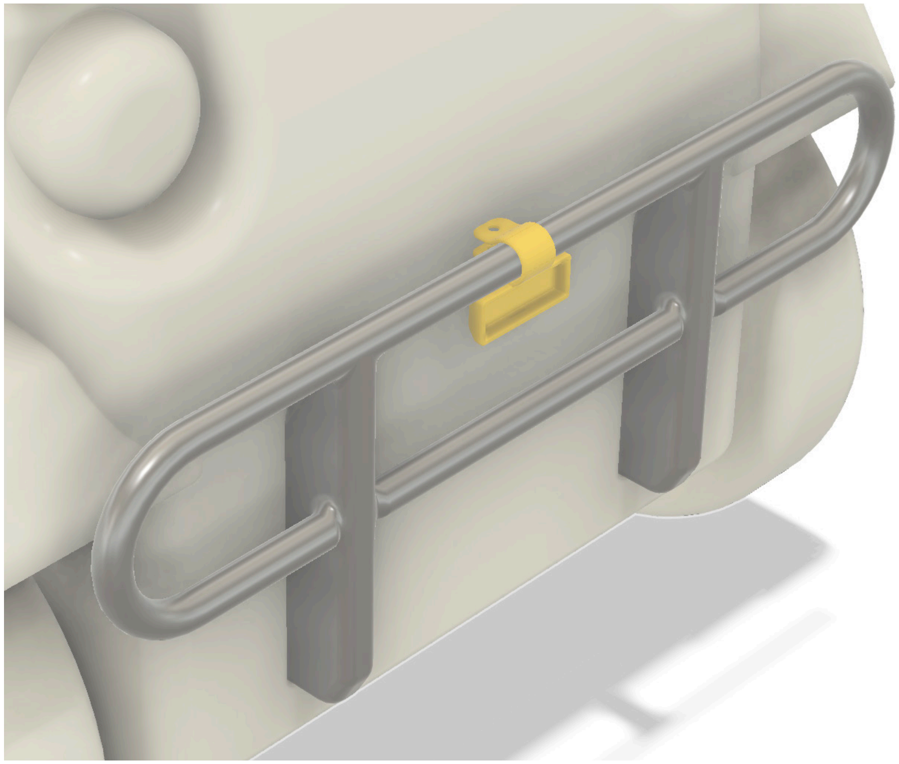


Figure 46. Tramper scooter CAD with magnetic attachment

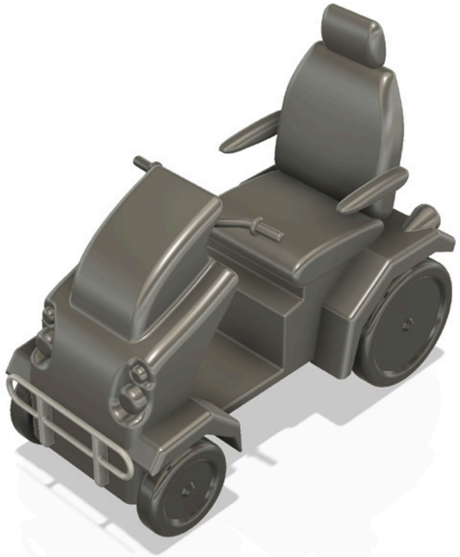


Figure 47. Tramper scooter CAD

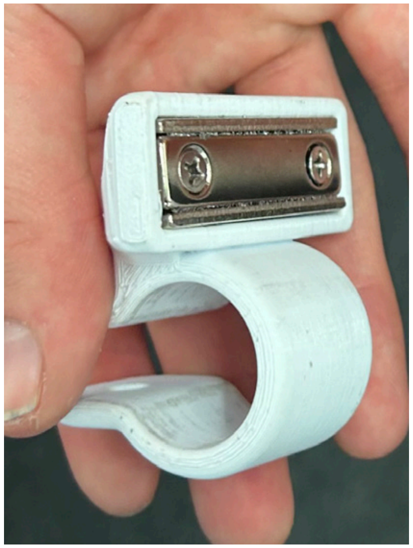


Figure 48. Prototype attachment

4.8 MATERIALS & MANUFACTURING

PLATE FRAME

The frame of the push plates could be constructed from welded galvanised steel rods, similar to gate 8 at the COAT. This will provide the strength and structure needed for pushing the plate whilst allowing the plate to be thin to keep the distance between the two magnets short.

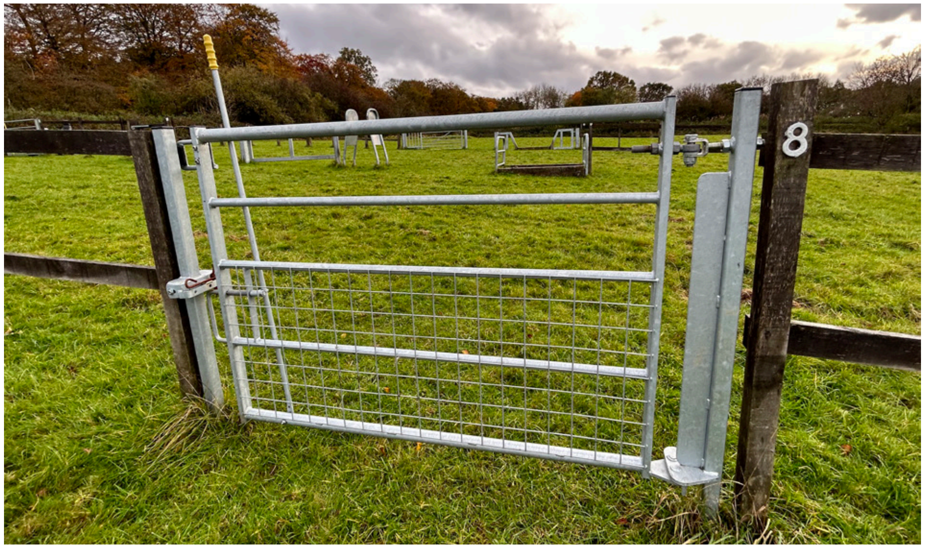


Figure 49. Welded steel gate leaf

PLATE DISTANCE

The plates being moved closer together and more parallel to the frame will reduce instances of farm animals getting stuck or debris getting wedged in the gate.

PLATE SIZE

Keeping the plate as small as possible will help keep down costs. The easy latch can be fitted a bar lower, but the 4th bar is preferred by pedestrians (Centrewire, 2015), so the height is fixed, but the width can be reduced to save costs.

PLATE MATERIAL

Wood- Often used for gates. It would not be very strong as a thin piece, and its strength is perpendicular to the force that will be applied. It is also prone to warping and rotting outdoors, especially when thin.

Figure 50. (britishhardwoods 2024)

Plastic- Recycled plastic benches are already distributed by Centrewire and are great for outdoor use. This is typically rotationally moulded, so it may be difficult to manufacture thin enough. It would be softer on the vehicle on impact and less likely to cause damage.

Figure 51. (Centrewire, 2023)

Metal- Non-ferrous metals would be required as ferrous metals, such as galvanised steel, would interfere with magnets. Therefore, aluminium or stainless steel would be suitable. Also, they are durable, can be made very thin whilst retaining strength, and are harder to tamper with than other materials.

Figure 52. (RS, 2024)

4.9 PROTOTYPE DEVELOPMENT

A 1:4 replica of a standard Centrewire footpath gate was modelled as a base to test the mechanisms. Embracing the craftsmanship of gate making, the frame was constructed from pine using mortise and tenon joints.

Miniaturised handmade metal components were manufactured in the workshops. Further details of the making can be found in appendix J

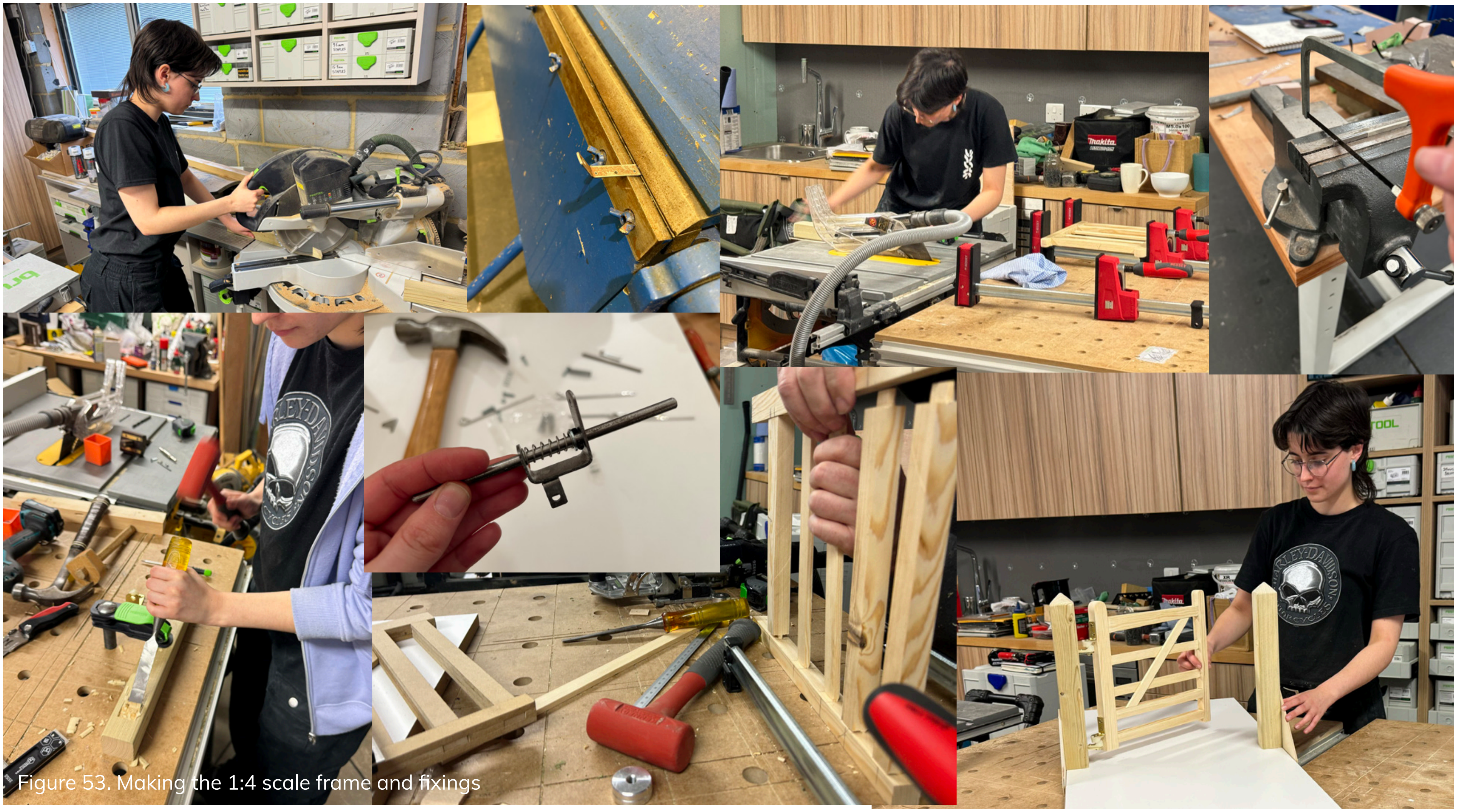


Figure 53. Making the 1:4 scale frame and fixings

The mechanism was redesigned to fit onto the new gate, with the gap between the plate and gate reduced to meet the requirements for lamb safety. Clear acrylic panels were used for the plates for visibility, as some users had struggled to see the mechanism in the previous models.

The parallel plates were easier to push but had more of a tendency to twist out of alignment. This was also due to the weak temporary joining methods and thin support rods used; these will be improved in future modelling, but redesigning the frame shape may also be needed.

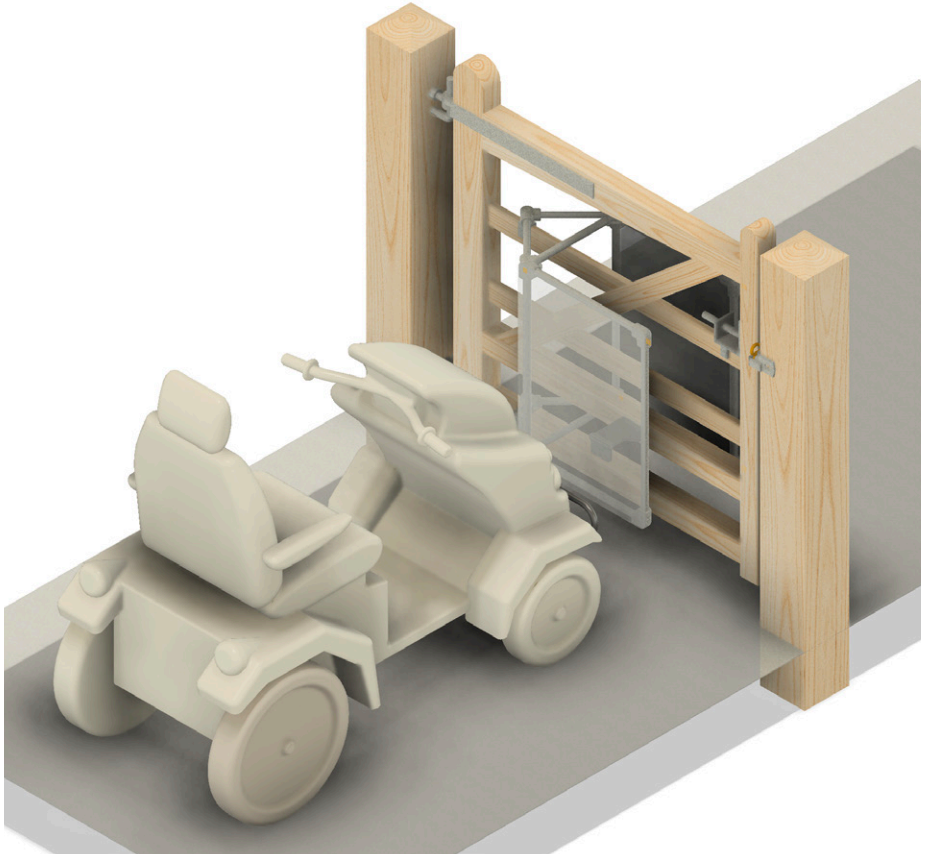


Figure 54. Development prototype CAD

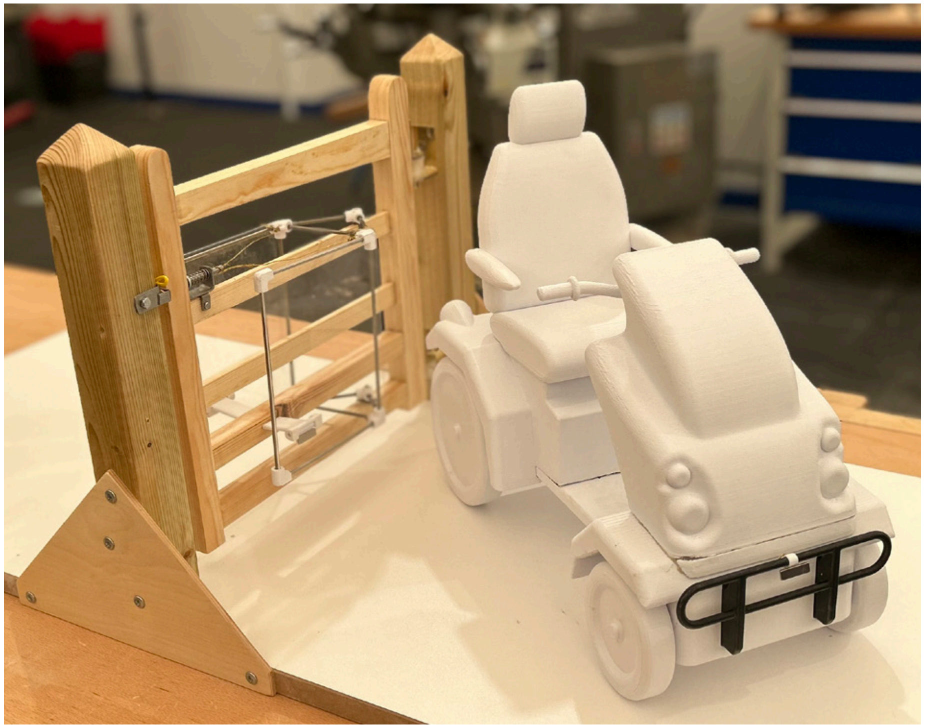


Figure 55. 1:4 scale development prototype Model and Scooter

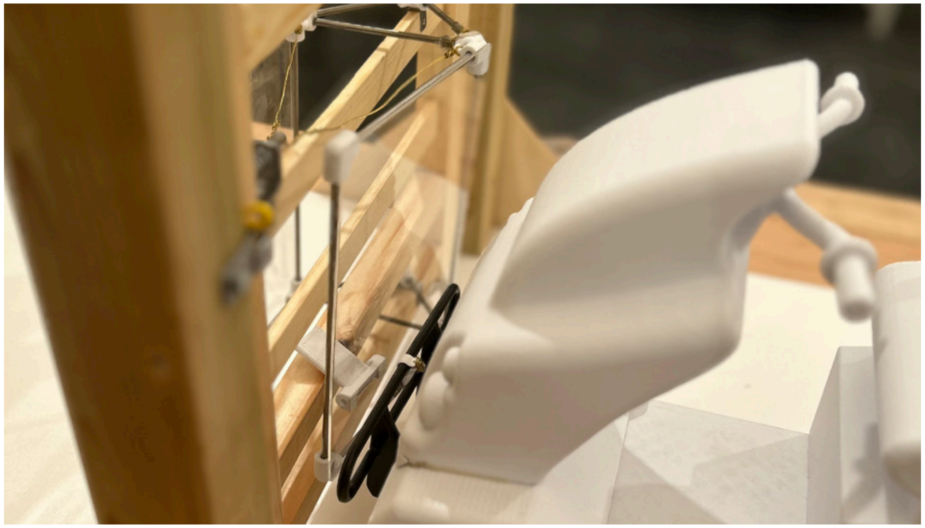


Figure 56. Twisting and misalignment when pushed

V1
Intended to replicate the block in the previous model. It ended up being a little too short, which meant the gate could be partially pushed.

V2
A longer iteration of V1. It was a better fit within the space, with less movement. The small surface area at the end may make it easy to bump over the crossbar.

V3
Iteration of V2 with a slight overhang added at the end. The larger surface hitting the crossbeam reduces the risk of bumping over. Occasionally, the overhang rests on the cross beam instead of returning, and its shape also has risks of getting caught on the other side, such as an.

V4
Iteration of V3, but with a smoother shape that glides back off the crossbar more easily.

V5
Iteration of V4 with a larger overhang, much less risk of bumping up, and the shape may get caught on the bar and remain open; this happened a few times during testing.

V6
Iteration of V5, which has a more rounded end and returns to its initial position more easily. V5 and V6 may be overly big, and a size between those and V4 would be a happy medium.

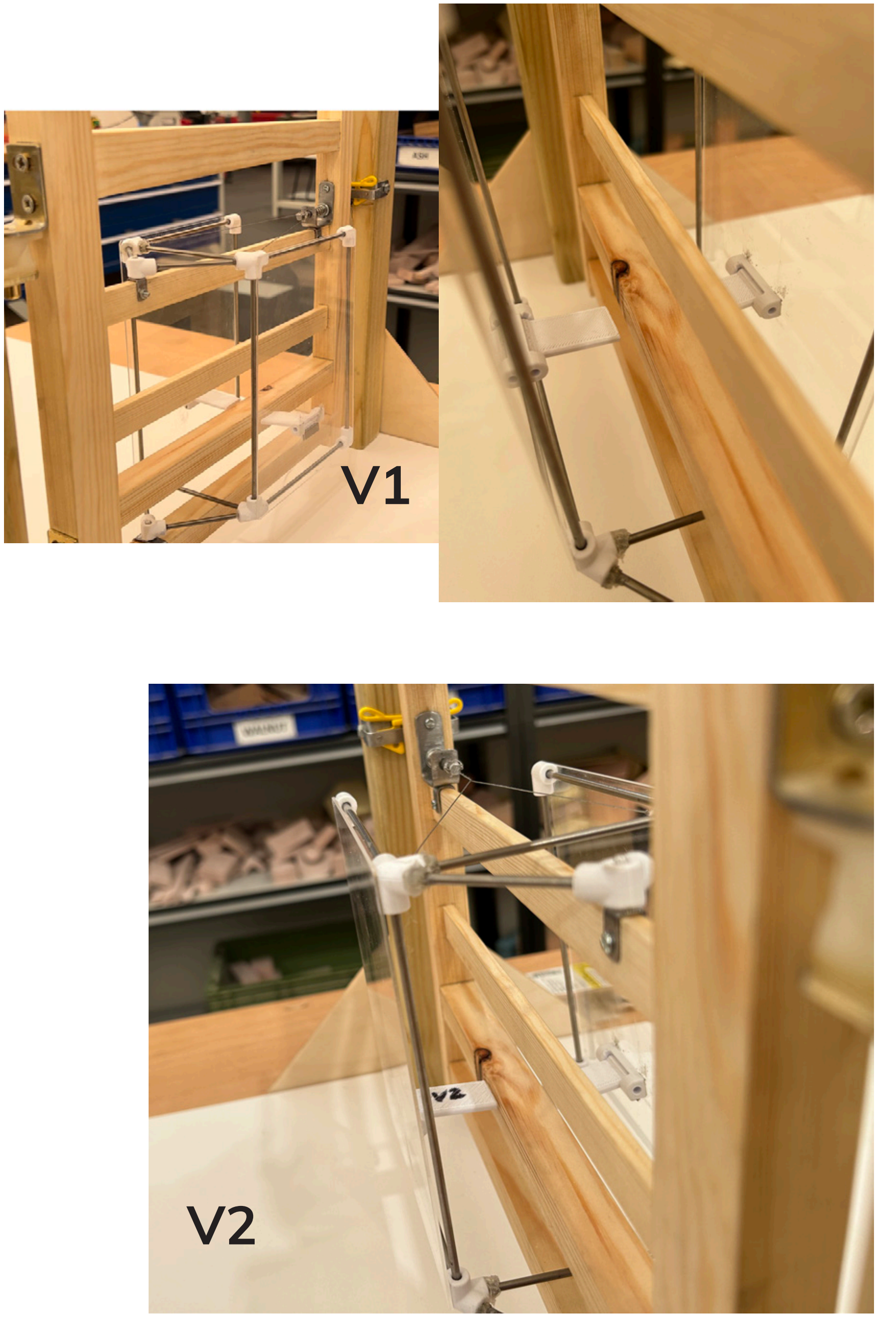
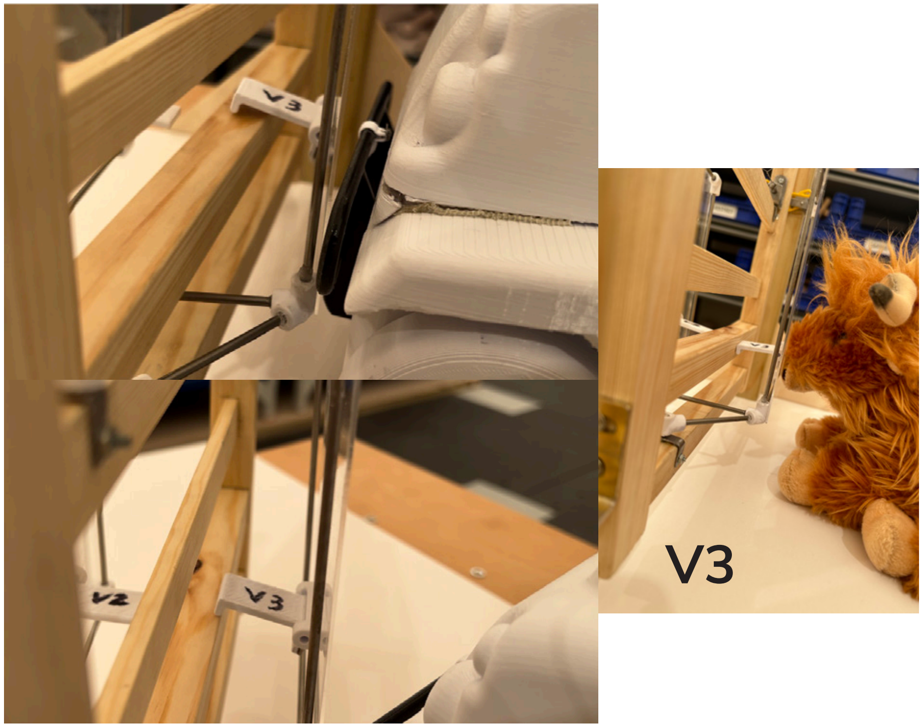
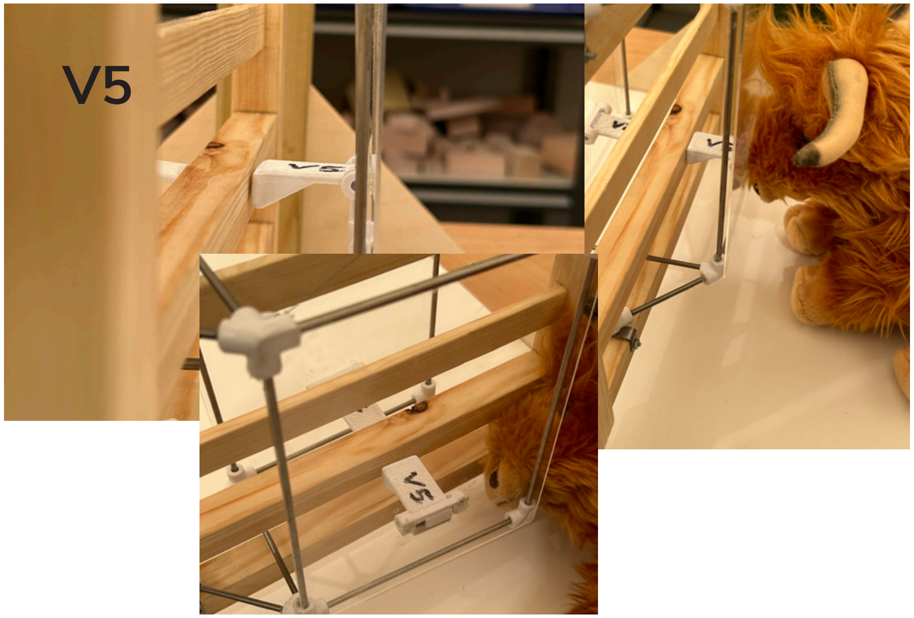
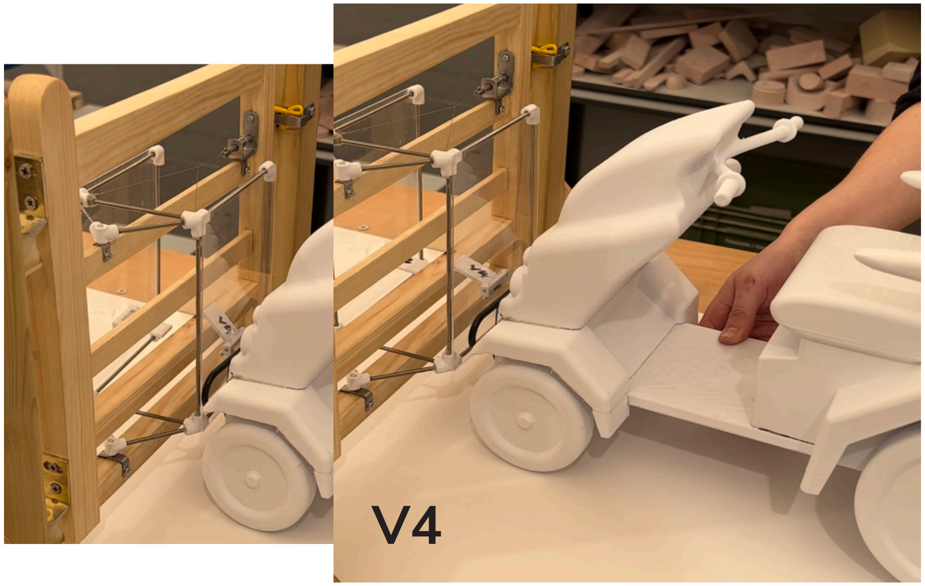
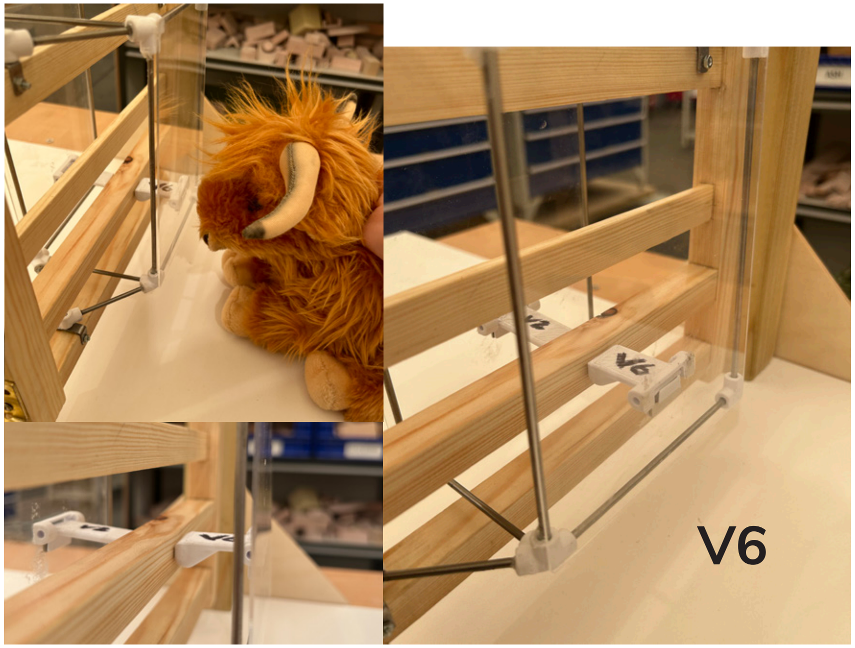


Figure 57. Blocker development iteration testing V1-6









BLOCKER ITERATIONS

4.10 BLOCKER DEVELOPMENT

After testing the blockers, the form was further developed, and design for manufacture was explored. The shape was changed to stick up instead of hanging down, lowering its centre of gravity, preventing accidental knocking over and reducing the chances of it getting stuck on top of the crossbar. The final material solution was a folded non-ferrous metal sheet section for the magnet and axil, with a folded metal bar welded to it which butts up against the gate leaf. It aims to use minimal material and maintain strength.

The magnet would be enclosed in a plastic casing to protect it from the elements, and reduce the risk of corrosion or other surface damage that may escalate demagnetisation. This was designed to be injection moulded, so draft angles were required to ensure it was suitable for this process. Although it would generally be obscured from view, colouring it yellow would help highlight this feature within the product.

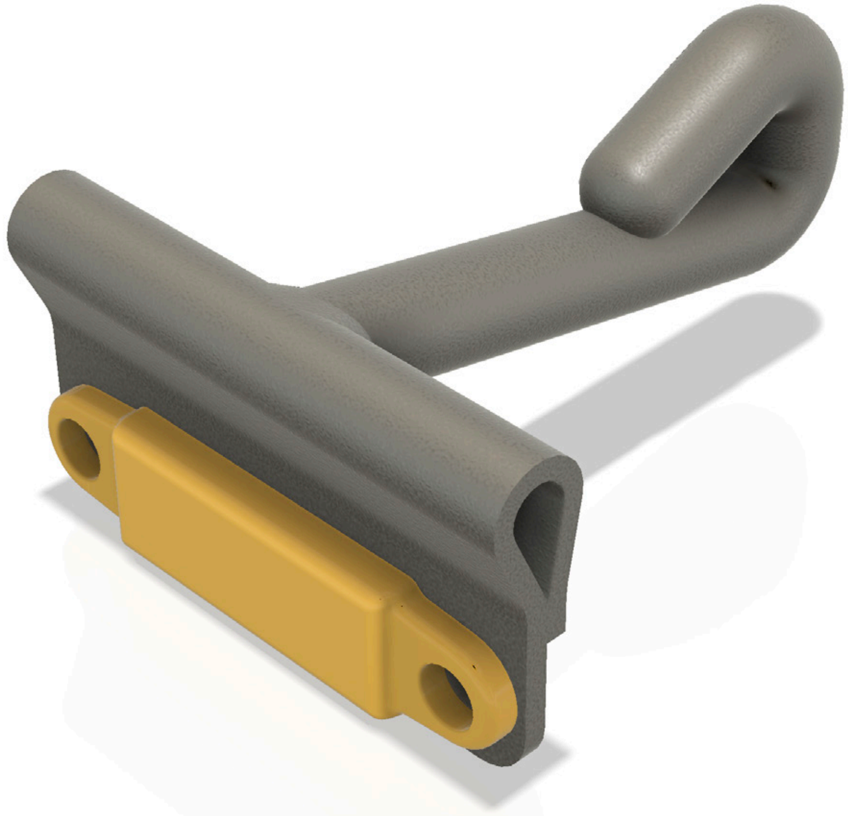


Figure 58. Design of the blocker and magnet casing for the gate

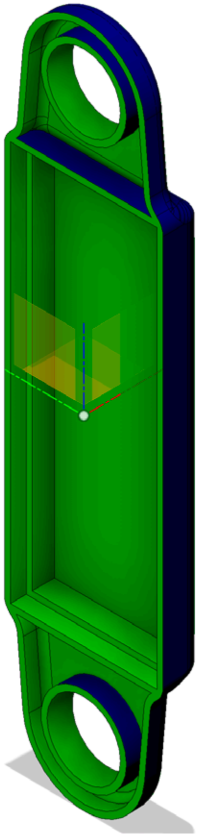


Figure 59. Draft analysis of the magnet casing for injection moulding

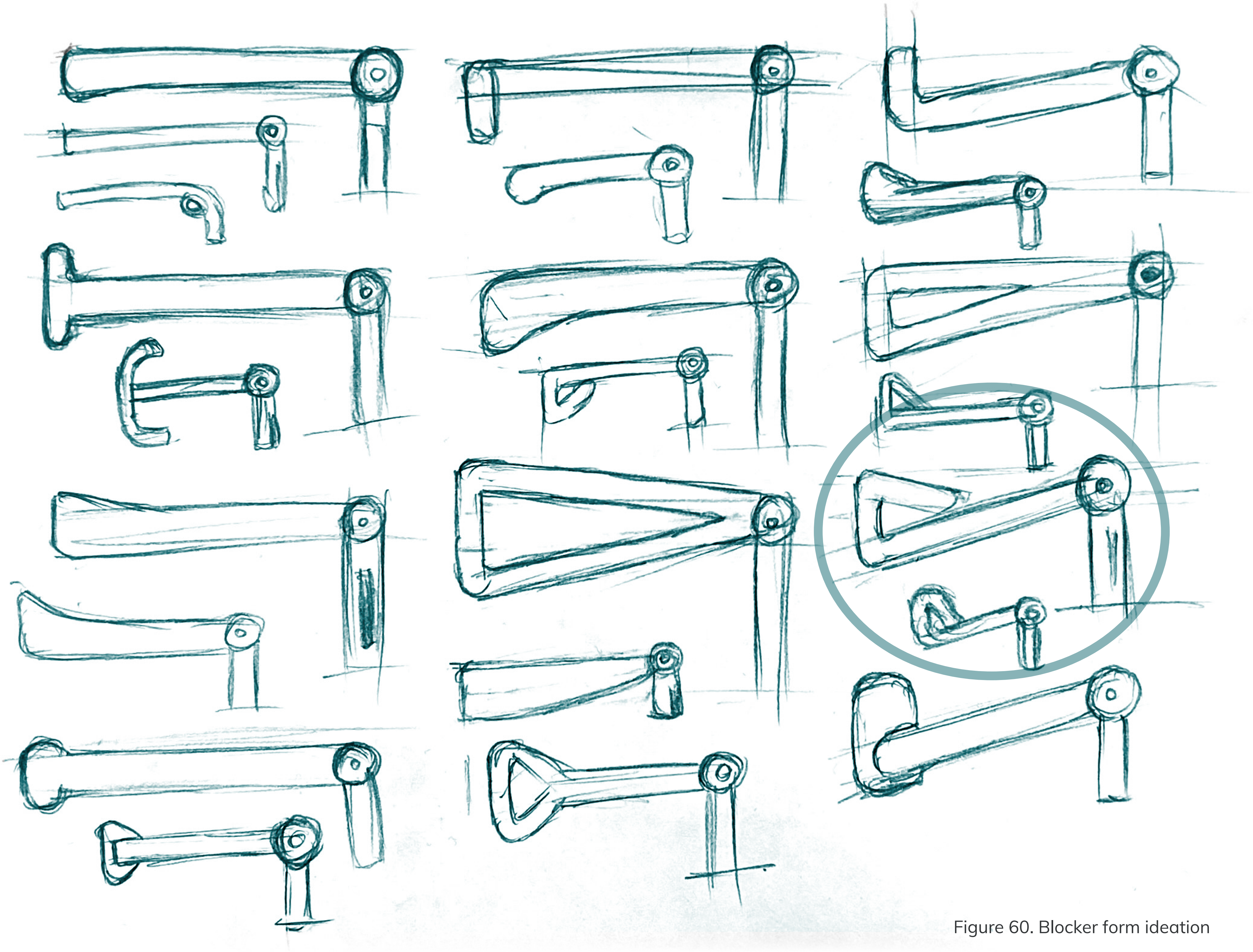


Figure 60. Blocker form ideation

4.11 MAGNET TESTING

The magnets needed to be tested at full scale to ensure they were still functional at that size and to check for strength-related safety concerns. A full-scale section of a centre wire gate leaf was mocked up as a stationary rig to test. The pivot frame was reinforced with two additional bars across it to reduce the warping issues. The bolt unit was kindly provided by Centrewire.

Reclaimed materials were used where possible to reduce costs and environmental impact. The timber was reclaimed from a building site hoarding, and the plate frame was made from old galvanised steel bridle handles provided by Natural England, which were no longer needed and had been replaced with new trombone handles at their site. More details of the making can be found in appendix K.

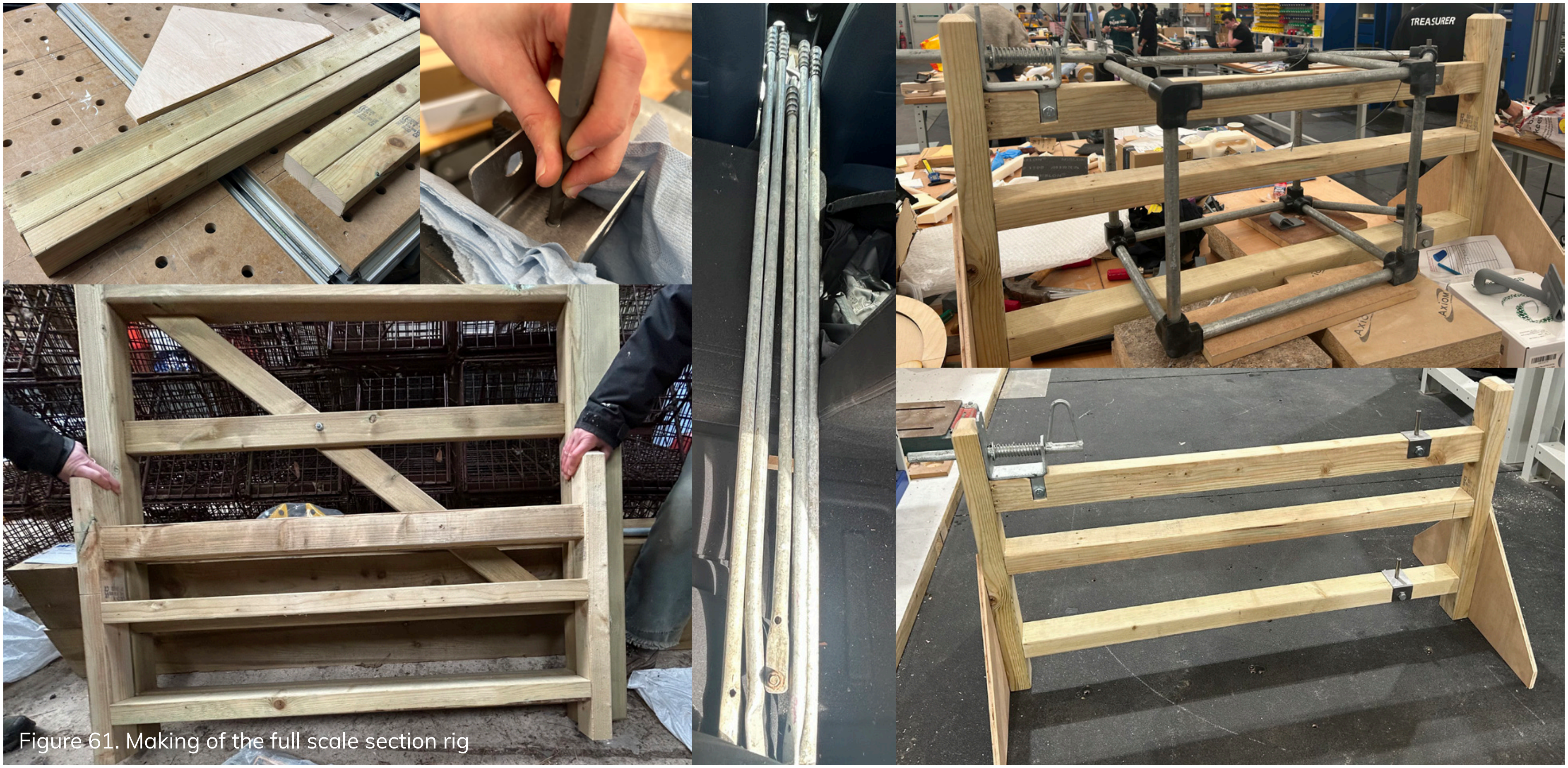


Figure 61. Making of the full scale section rig

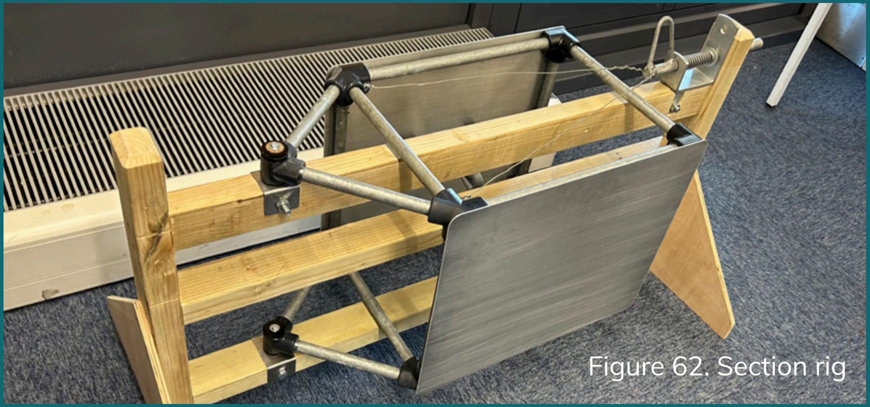


Figure 62. Section rig

EXPERT CONSULTATION

Employees of Natural England were consulted at the COAT. They preferred aluminium plates to plastic plates due to their strength and ability to last long-term in the elements. The wires needed to be durable and suitable for outdoors but also able to bend and return to their shape. A representative of Natural England recommended using metal strand wire, which is typically used for electric fences or bike brake cords. They were kindly able to provide reclaimed strand wire for this prototype.

When the blocker was initially tested, it was barely lifting. However, it was quickly realised that the magnet was too far from the pivot, so the distance it moved did not rotate the pivot around enough. Fixing it closer to the pivot resolved this, so the blocker was modified.

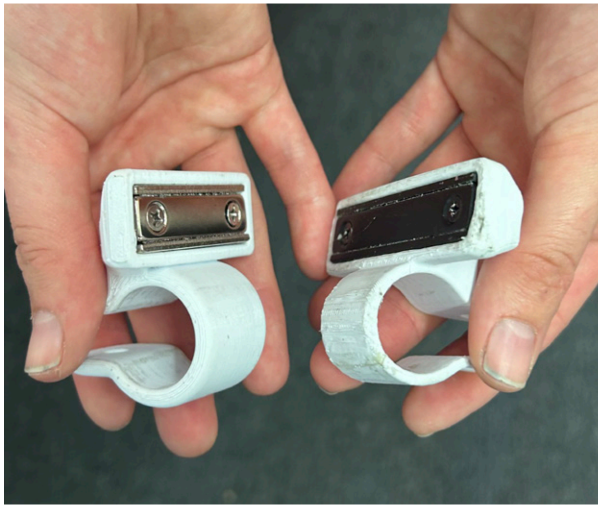


Figure 64. Magnetic attachment modification

The magnetic attachments were made thinner making them easier to put onto the bar but they were prone to snapping. A less brittle material or a different style of fastening may improve this.

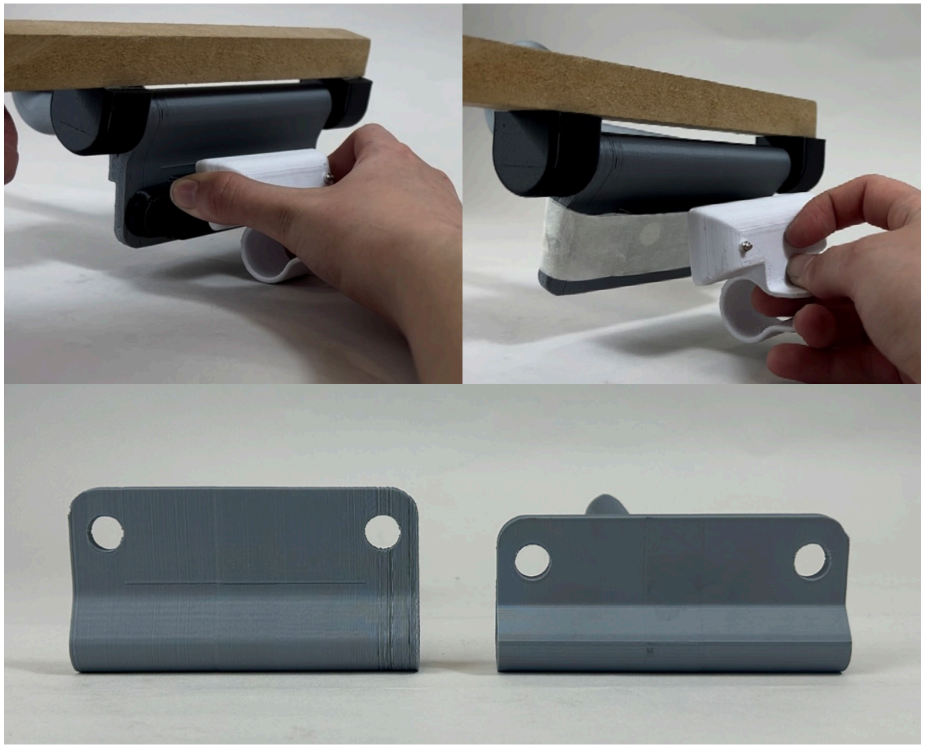
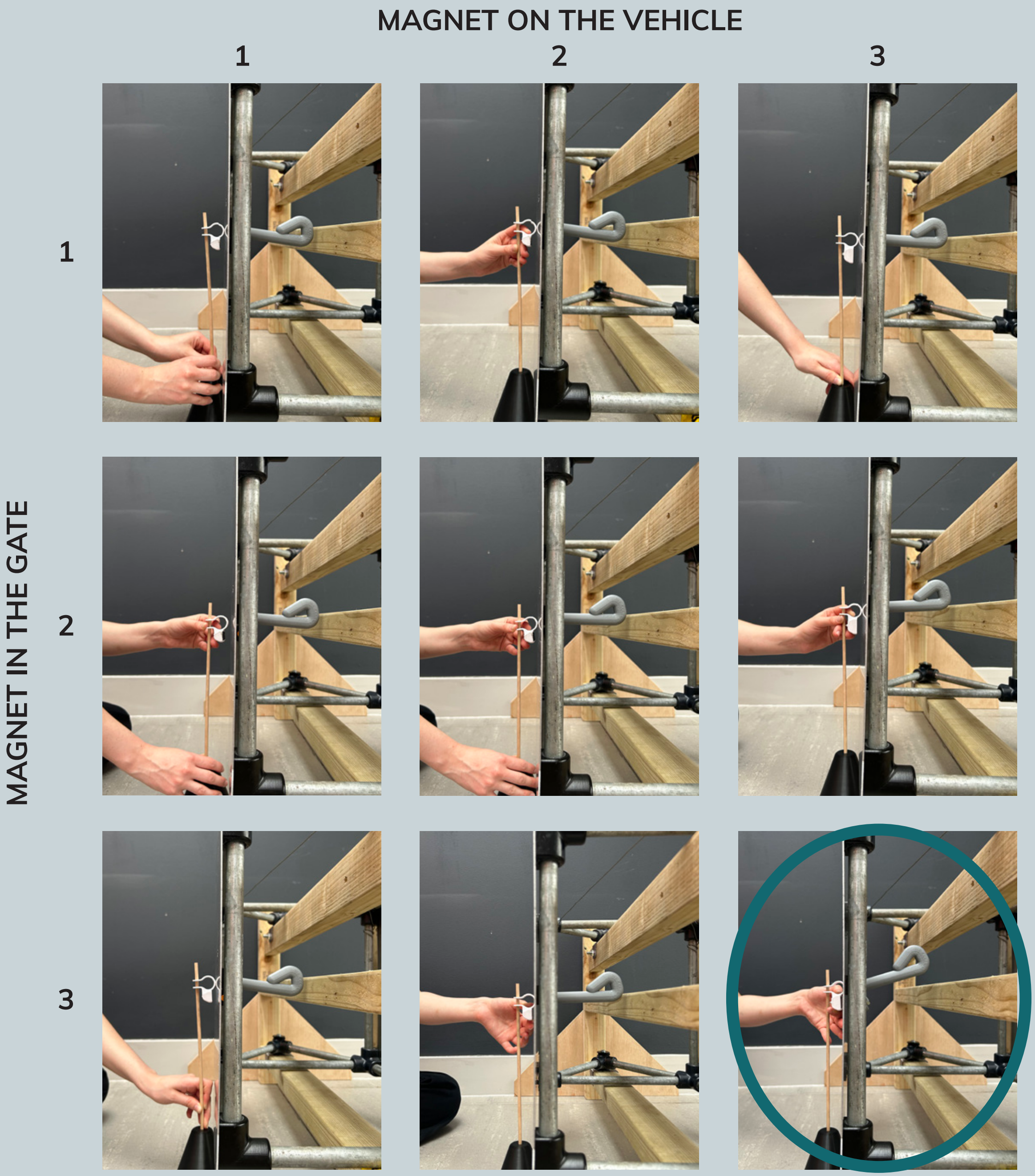


Figure 63. Full scale blocker adjustment



MAGNETS

Neodymium magnets were used due to their superior strength. The magnets used for testing were chosen as the screw holes ensured they would stay secured and not come off. They were tested within the plastic casing to match the actual set-up. Three strengths of magnets were acquired to test. Ideally, the lowest force magnets that effectively do the job will be used. Magnet three in the gate was the only one that worked consistently, although when combined with magnet two on the vehicle, the blocker just about cleared; magnet three worked every time and was easier to line up, so it is an ideal choice.

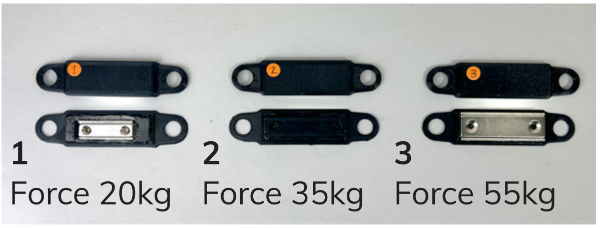


Figure 65. Test magnets

4.12 VEHICLE ATTACHMENT DEVELOPMENT

Bike light fittings are similar in application to the Magnet attachment for the mobility scooter; therefore, they were explored to aid the development of the attachment. All the lights cost around £5 for a pack of two, making them a good comparison that would be viable to produce at a low price.

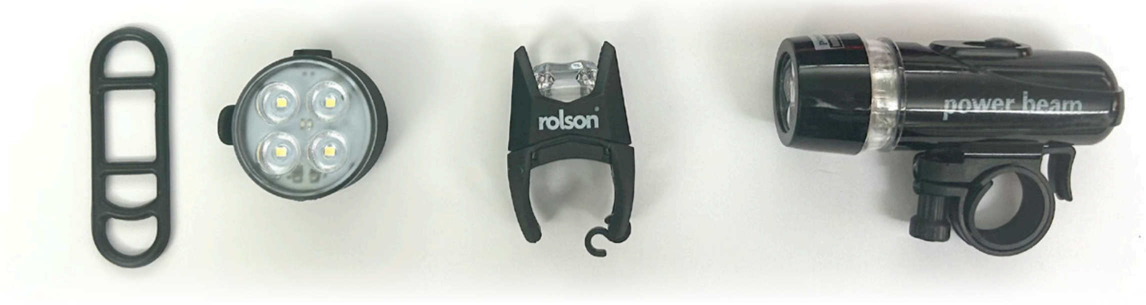


Figure 66. Budget bike lights

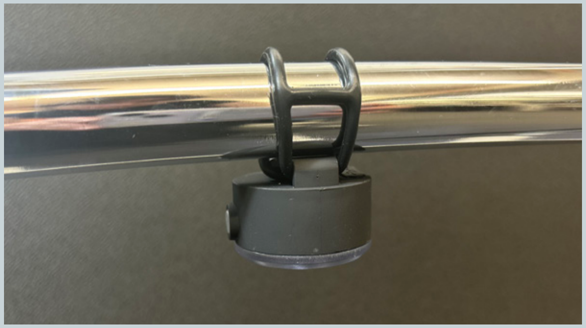


Figure 67. Light 1

1 - It is easy to attach; however, durability may be a concern; it already could move slightly and would loosen over time with no way to adjust it tighter. The light and fixing could be separated, which may be a good thing to have, i.e. one magnet casing and multiple fixings to choose from that would help it work with different vehicles

2 - It was too small to fit around the bar, but it would work nicely and has a nice form. It felt very sturdy but used multiple materials, and the hard plastic hook at the top already showed signs of overextension in the testing.

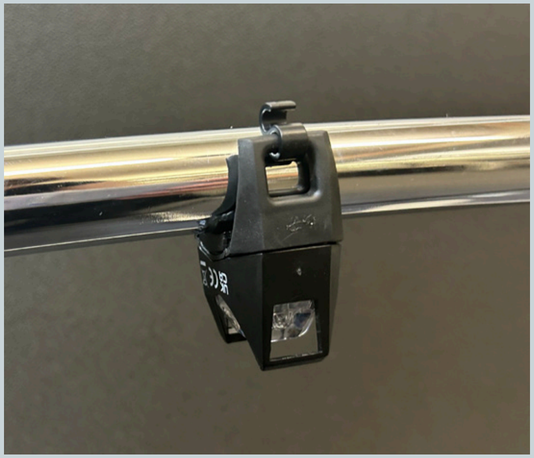


Figure 68. Light 2

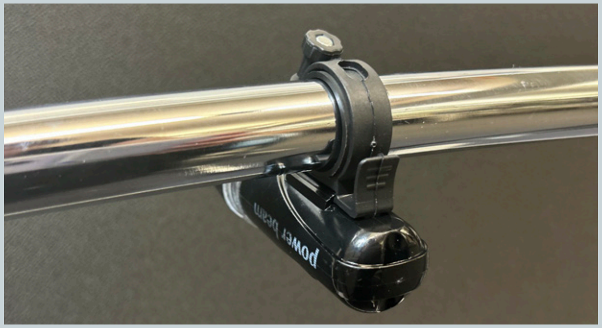


Figure 69. Light 3

3 - It has a screw that fastens it around the bar providing great adjustability and the ability to be further fastened if it loosens over time. It has a separate soft, plastic piece that stops slipping. It has the bonus of the light being removable from the fixing, but this does make it more bulky, and the way it is achieved is too fragile to translate to holding strong magnets in place.

AESTHETIC CONSIDERATIONS

Although the magnetic attachment could be made yellow for visibility and to be in line with key gate touchpoints, black was chosen. This would not make it stand out, change the vehicle's aesthetics, and not look dirty as quickly. The casing surrounding the magnet would be a hard injection moulded plastic, and the attachment would be fastened with a bolt made from a flexible polymer. An example could be TPU, which can easily be wrapped around the bar.

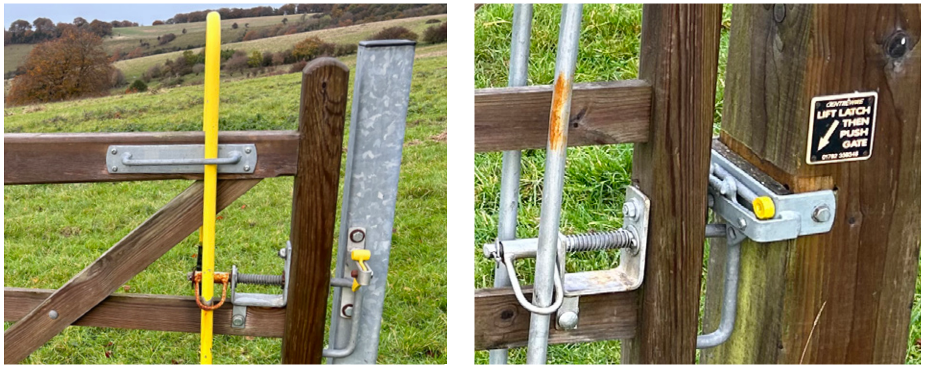


Figure 70. Yellow touchpoints on footpath gates

FINAL MAGNETIC VEHICLE ATTACHMENT CONCEPT

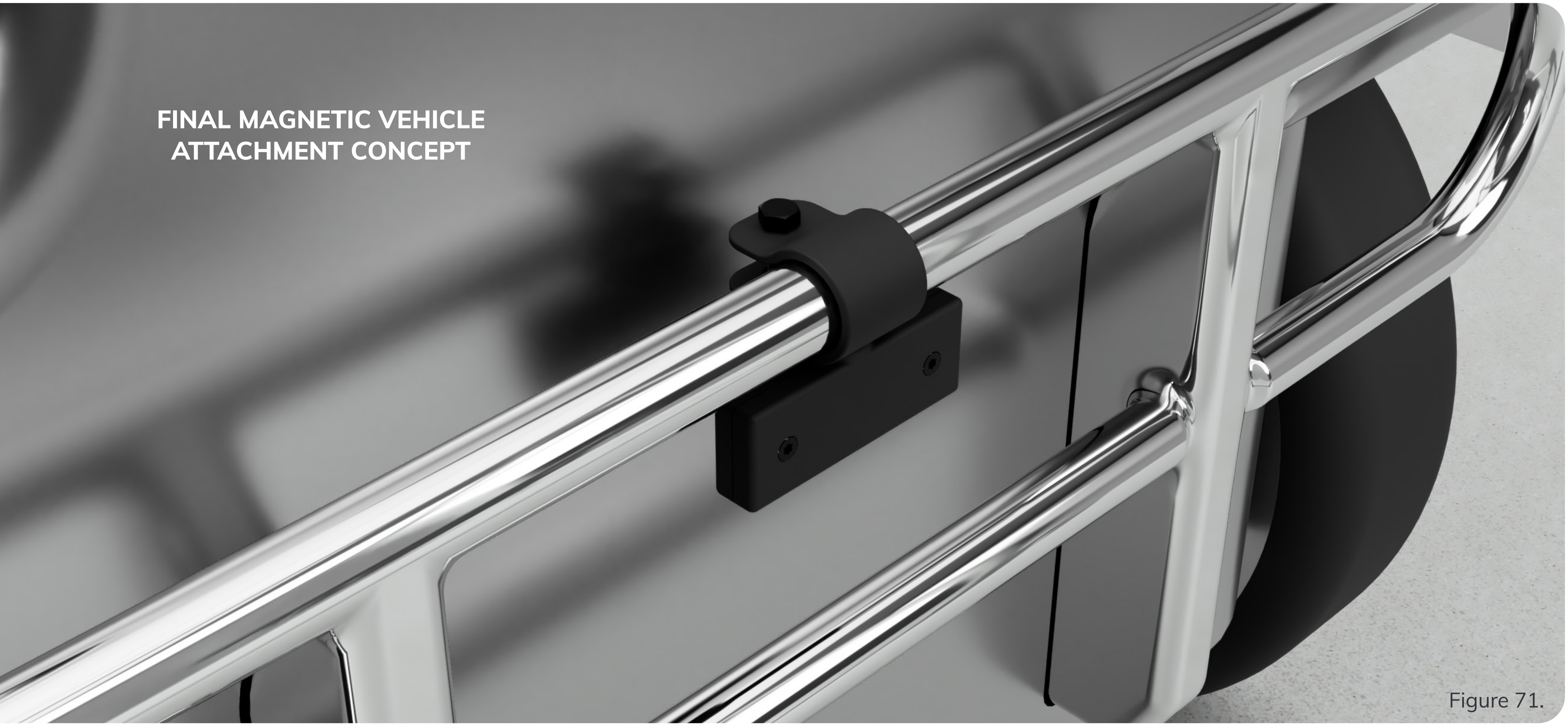
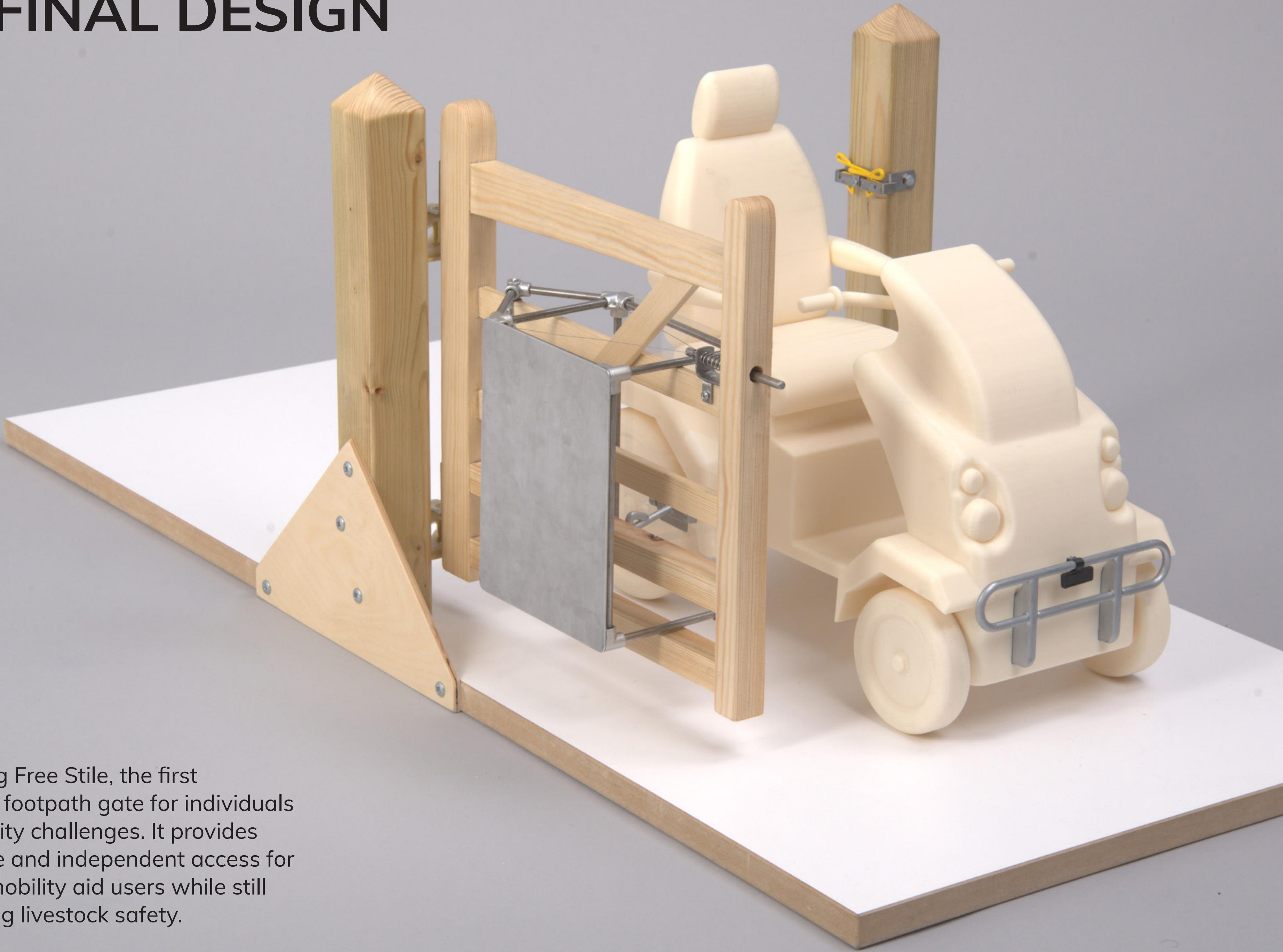


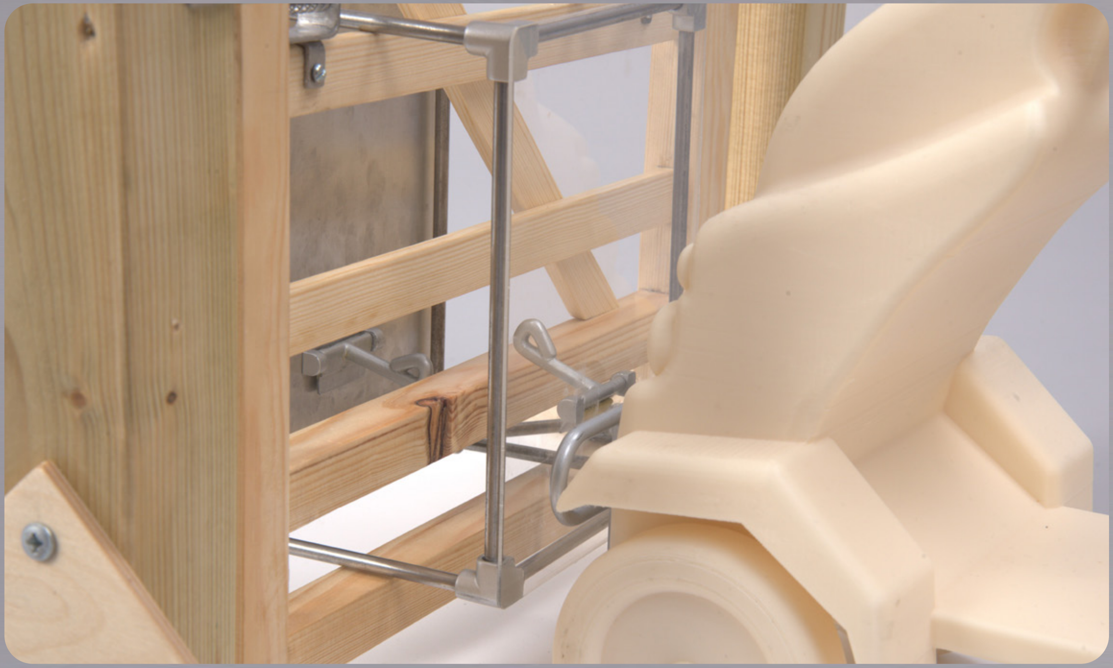
Figure 71.

5 DELIVER

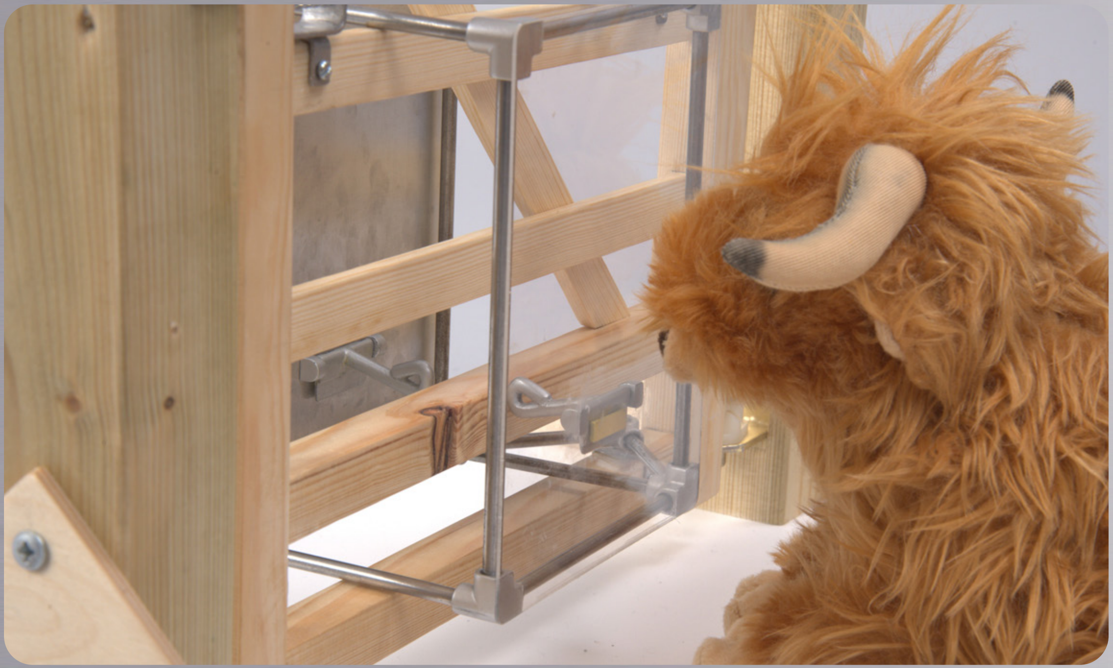
5.1 FINAL DESIGN



Introducing Free Stile, the first accessible footpath gate for individuals with mobility challenges. It provides hands-free and independent access for wheeled mobility aid users while still maintaining livestock safety.



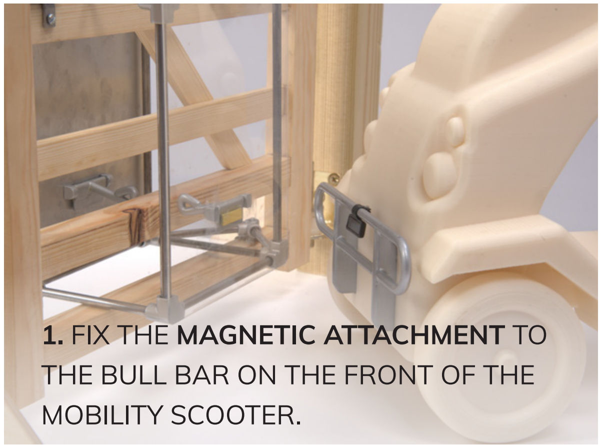
HANDS-FREE ACCESS FOR WHEELED MOBILITY AID USERS.



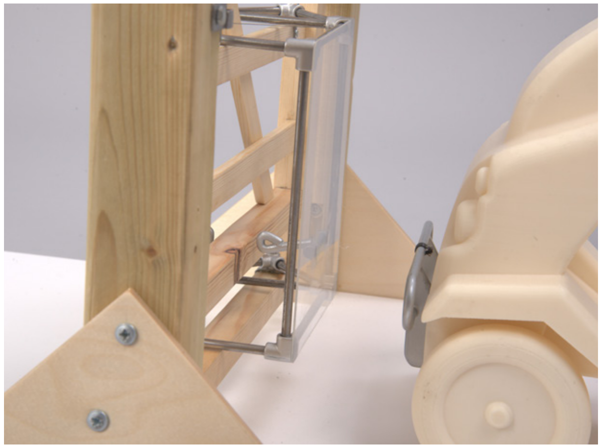
LIVESTOCK ARE RESTRICTED

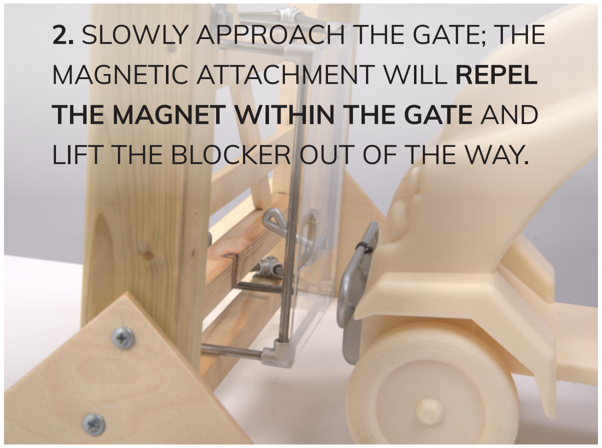
STORYBOARD

The magnetic attachment is fixed to the front of the vehicle. With this, the driver can simply drive through with ease; the magnetic attachment repels the other magnet, lifting the blocker and allowing the push plate to unlock the gate.

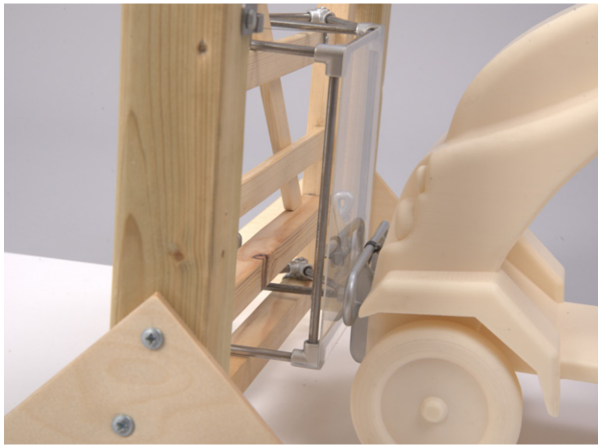


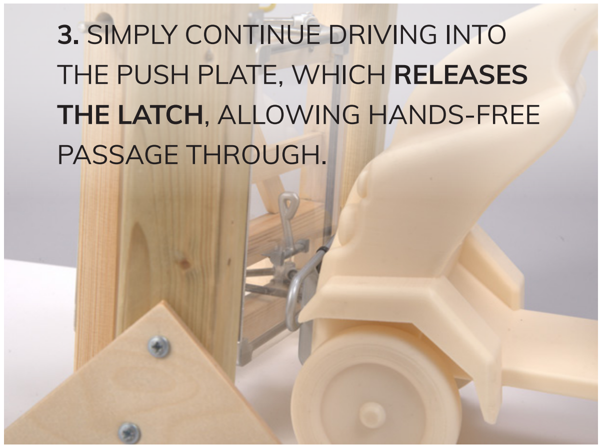
1. FIX THE **MAGNETIC ATTACHMENT** TO THE BULL BAR ON THE FRONT OF THE MOBILITY SCOOTER.



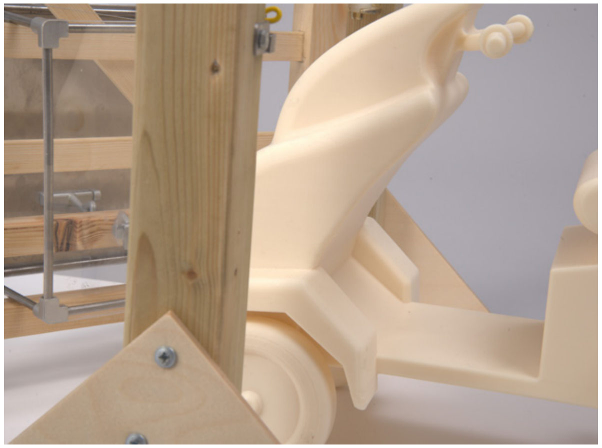


2. SLOWLY APPROACH THE GATE; THE MAGNETIC ATTACHMENT WILL **REPEL THE MAGNET WITHIN THE GATE** AND LIFT THE BLOCKER OUT OF THE WAY.



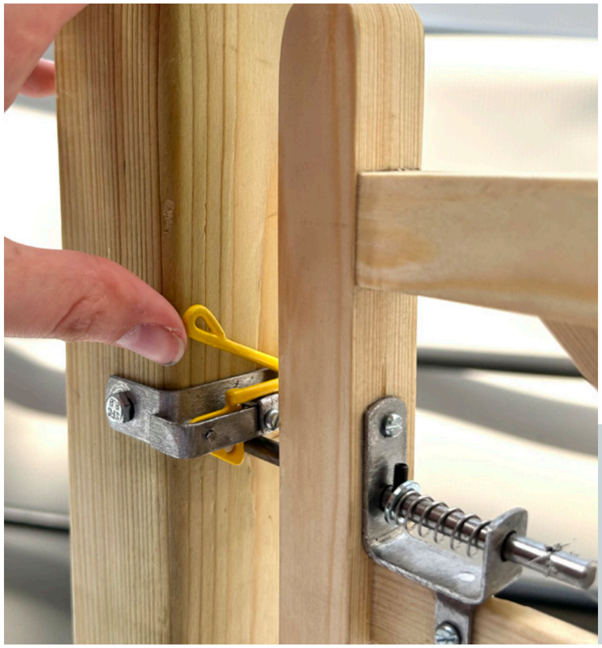


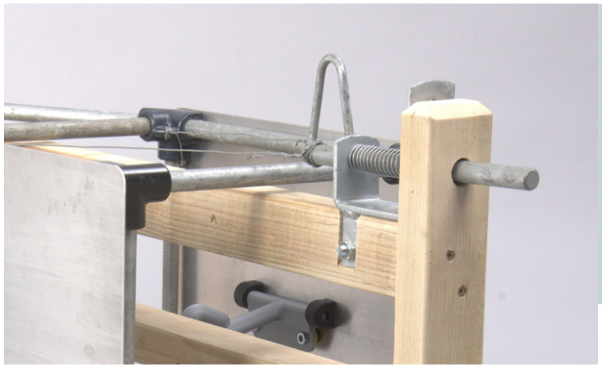
3. SIMPLY CONTINUE DRIVING INTO THE PUSH PLATE, WHICH **RELEASES THE LATCH**, ALLOWING HANDS-FREE PASSAGE THROUGH.



4. THE GATE **SELF-CLOSES** BEHIND THE USER, ENSURING LIVESTOCK ‘S SAFETY; THE BLOCKER ALSO RETURNS INTO PLACE ONCE OUT OF THE OTHER MAGNETS RANGE.

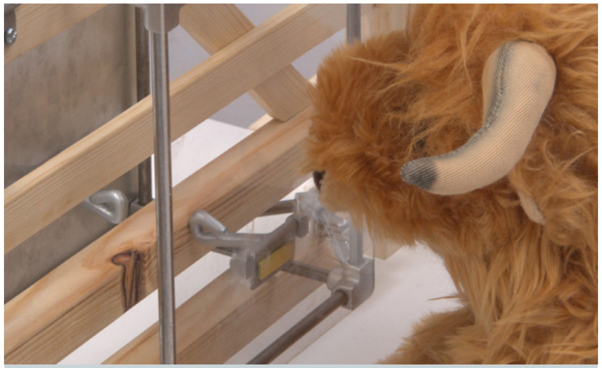
KEY FEATURES



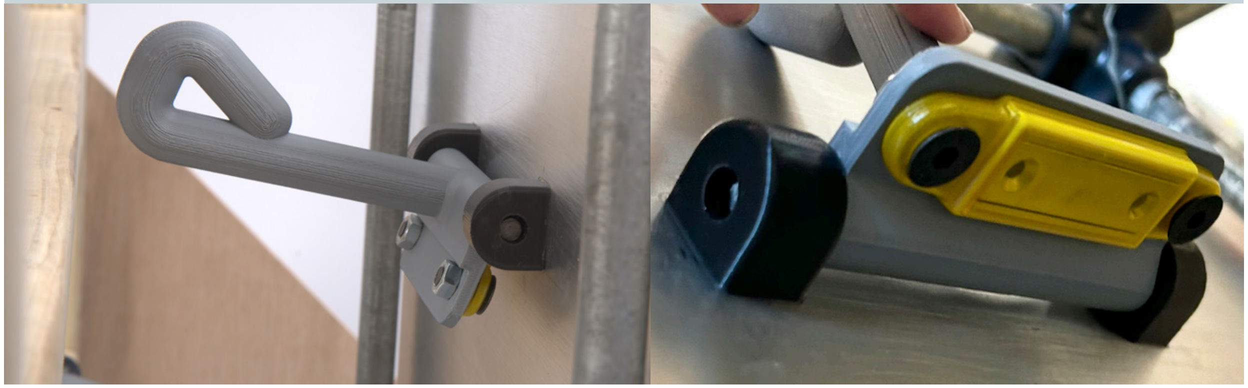


DURABILITY
It is made from durable materials, including galvanised steel and treated pine wood, making it suitable for impact and long-term outdoor installation.

EASY LATCH COMPATIBLE
Providing two ways to open the gate, instead of creating more barriers, adds more options.



CONCEALED OUTDOOR MAGNETS
Magnets are sealed within a plastic casing to reduce the rate of erosion and the risk of surface damage, ensuring they can last outdoors.

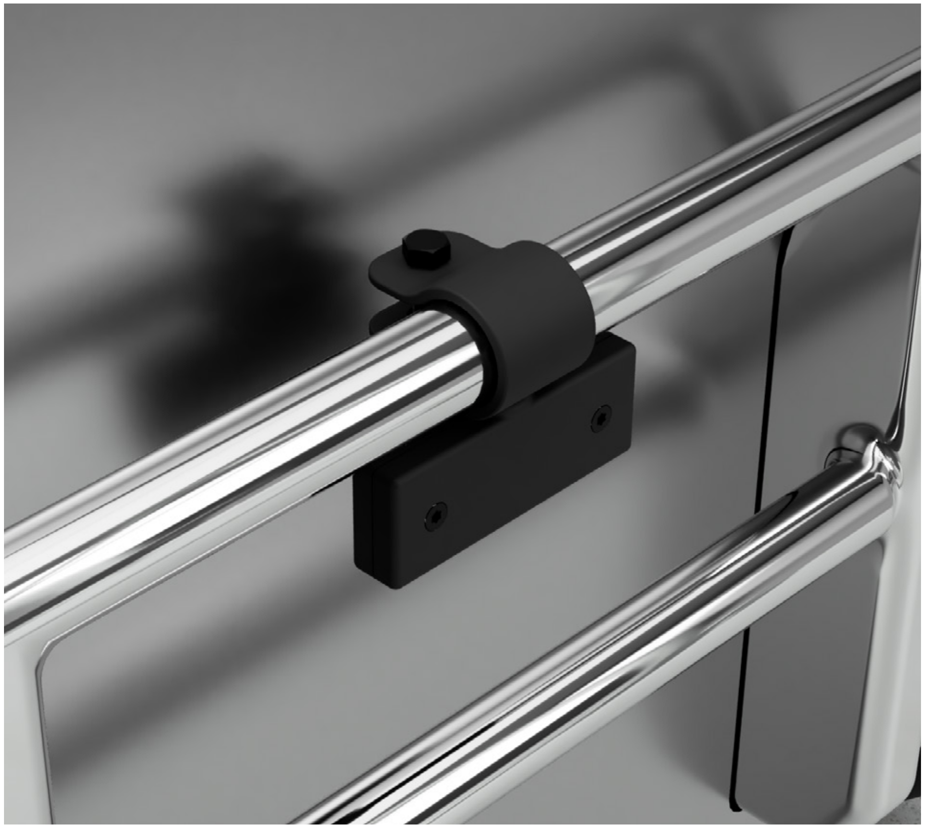


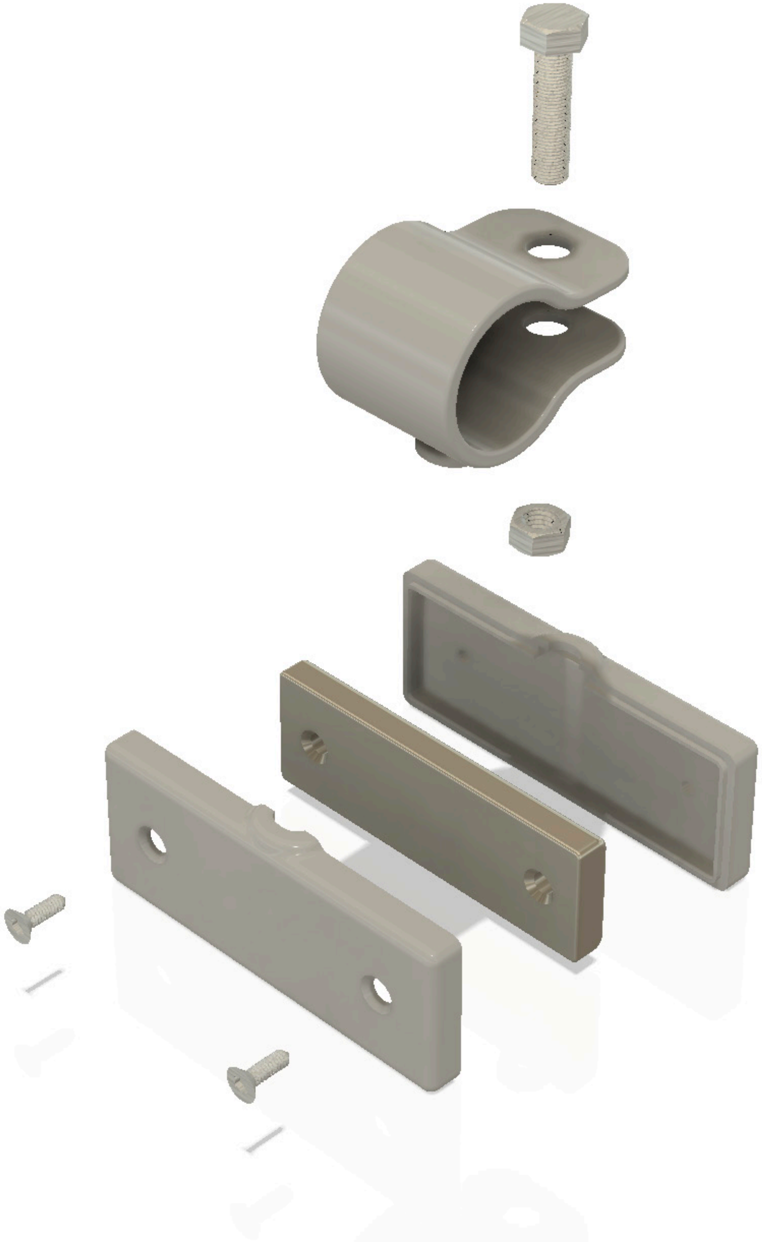
ANIMAL LOCK
The push plate can only be released when in the range of another magnet repelling; therefore, animals cannot unlock it. The gap between the gate and the plate is less than 6 inches, meaning that lambs cannot get stuck. Also, this means there isn't space for cows to get their nose in, and if they do, they will only be able to move the blocker but not the plate.

5.2 MAGPASS

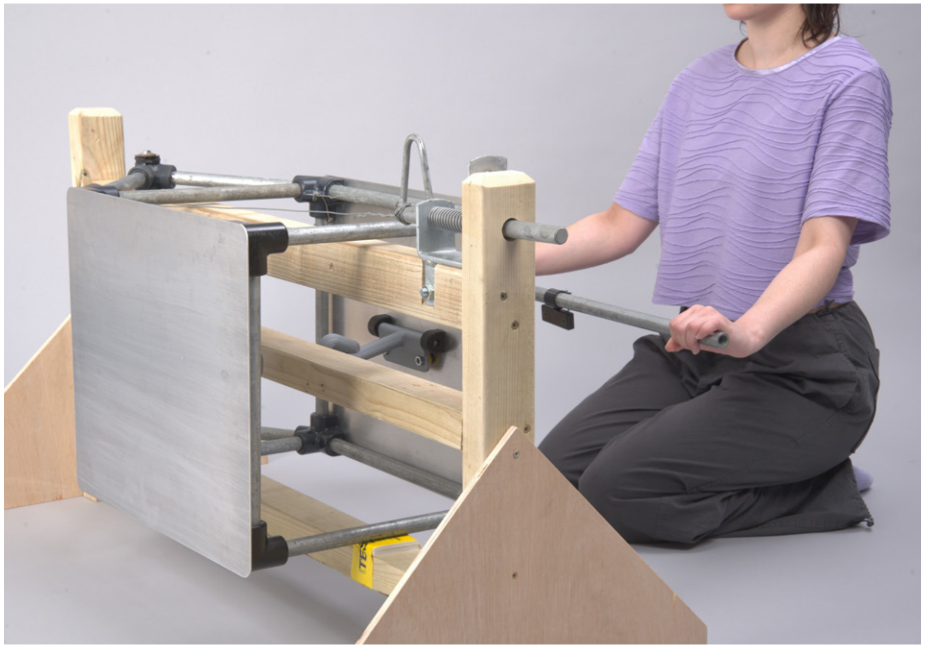
The magnetic vehicle attachment simply attaches onto the bull bar as easily as a bike light and grants hands free access. The magnets casing is made via injection moulding to create a solid enclosure at scale at a low cost.

Users could alternatively use other magnets instead, further improving accessibility.

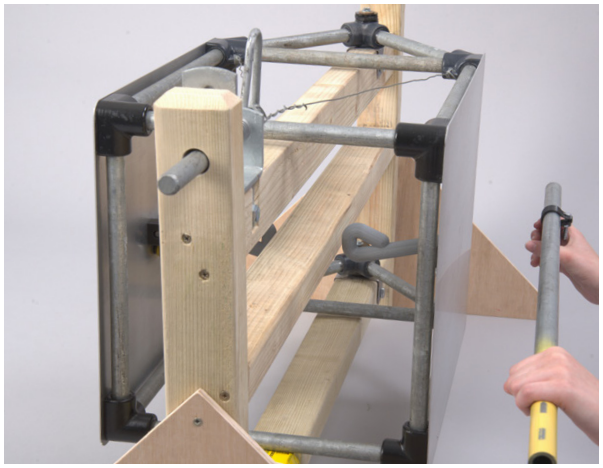


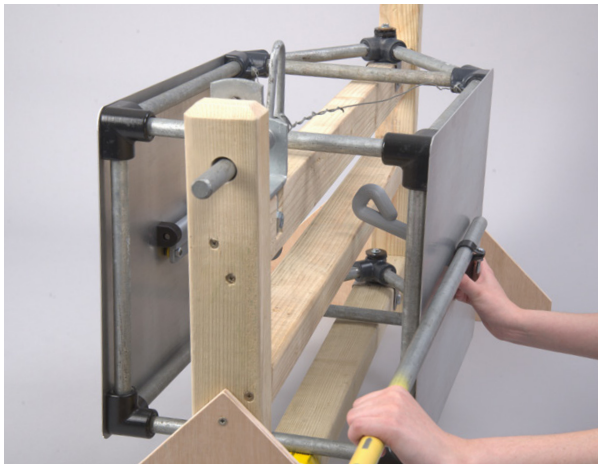


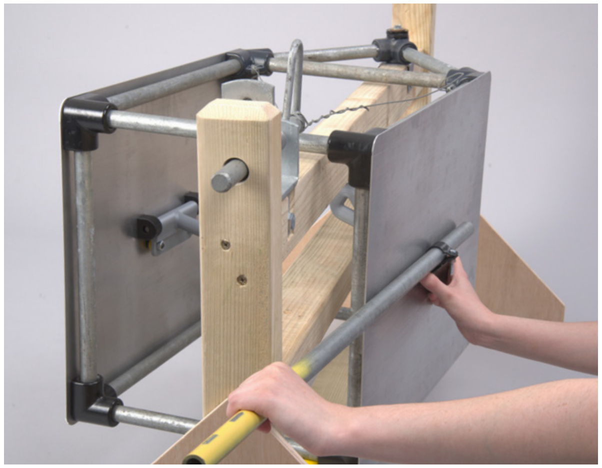
5.3 FULL SCALE TESTING



This life-size sectional rig of the gate leaf demonstrates the magnets working within the mechanism at full scale. The magnetic vehicle attachment repels the blocker's magnet, lifting it just high enough to clear the bar and allow the plate to be pressed. The blocker resets when the plate rests, but as an additional feature, the gate slamming will ensure it knocks back down.







5.4 EVALUATION AGAINST PDS

1. PERFORMANCE

1.1 The product must be independently operable by wheeled mobility aid users

1.2 The product must restrict livestock

1.3 The product must be on par with existing products in its usability by other walkers

1.4 The product must operate and open in both directions

1.5 The product must self-close

1.6 The product should stay open long enough for a wheeled mobility aid user to get through

1.7 The product should work with a range of wheeled mobility devices *It is optimised for tramper mobility scooters and will still allow everyone to use the easy latch, however more development is needed to finalise hands free access for other wheeled mobility aids.*

1.8 The product should be a low-tech solution (e.g. not powered)

1.9 The product may be usable by horse riders *A trade off in the final solution is that it's not designed for horse riders as it is a footpath gate but this was agreed with the team to be a suitable compromise.*

2 ERGONOMICS

2.1 The product must operate hands-free without the need for users to stand up

2.2 The product must be easy to use with minimal physical exertion from the user

2.3 The concept must be functional at full-scale

2.4 The gap between must be a minimum of 1.1m wide to accommodate wheeled mobility aid users, but it could be wider

2.5 The product should be intuitive to use without additional training *It is straightforward to use, however users may need an initial explanation or demonstration to use it correctly.*

3 AESTHETICS

3.1 Touchpoints must clear to users and may be yellow *More development could be done to improve the visibility of the magnet alignment with the gate.*

3.2 The product aesthetics should align with existing countryside gates

4 MATERIALS

4.1 The product must be primarily made of Treated Softwood Timber and/or Galvanised Mild Steel

4.2 The product must be durable

4.3 The product must not use materials or substances that could leach into the environment or cause danger to animals

5 ENVIRONMENT OF USE

5.1 The product must be weatherproof and suitable for permanent outdoor exposure

5.2 The product should perform in the temperature range -15C to 35C

5.3 The product must not disrupt the aesthetics of the countryside environment

5.4The product must be compatible with existing fences and paths

5.5 The product should withstand the shock of the gate closing

6 SERVICE LIFE

6.1 The product must last a minimum of 10 years but should last 15-25 years (current gate lifespans 10-25 years) *Significant efforts have been made to improve it's chances of achieving this, but an outdoor test would be needed to get confirmation of this.*

7 MAINTENANCE

7.1 The product should require minimal additional maintenance within its service life compared to existing gates.

7.2 The product should be deconstructable to allow for replacement of individual components or modules *Further development and optimisation with Centrewire is required to improve the DFM and assembly of the gate.*

8 MANUFACTURING

8.1 The product should be suitable for batch production

8.2 The product must be suitable for manufacturing in the UK to reduce travel emissions

8.3 The product should aim to use minimal additional tech to keep manufacturing costs down

8.4 The product should use standard components and current manufacturing techniques where possible to reduce additional costs

8.5 The final manufacturing cost should not exceed 3x the cost to produce other gates

9 MARKET

9.1 The product designed is for disabled ramblers with mobility issues and must be suitable for wheeled mobility aid users in the UK

9.2 The product should be suitable to be pitched to Centrewire for manufacturing

9.3 The product would be distributed to Natural England and other Landowners.

9.4 The product should cost no more than 2x higher-end gates to purchase *This is reasonable, but more R&D would be needed to ensure this.*

9.5 The product could be subsidised by charities and local councils *This is very much still plausible, but has yet to have been explored within the constraints of the project.*

10 QUALITY AND RELIABILITY

10.1 The product must consistently work every time

10.2 The product should be able to withstand high wind, interest from animals and tampering from walkers, such as hanging on the frame

10.3 The tolerances should allow for the compression and expansion of metal and wood throughout the seasons

10.4 Any fragile components should be cased to avoid damage.

11 STANDARDS & LEGAL REQUIREMENTS

11.1 The product must not obstruct legal users of the rights of way.

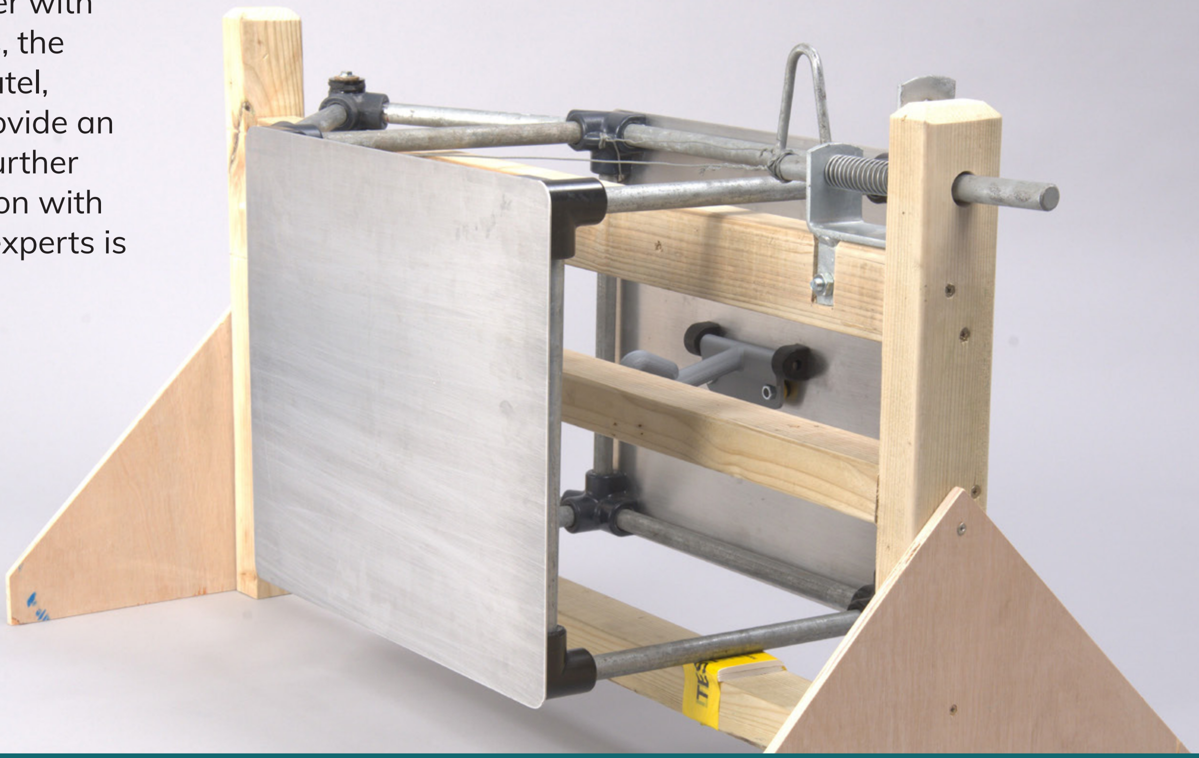
11.2 The product must comply with BS5709:2018 (British Standard for Gaps Gates and Stiles)

12 INSTALLATION

12.1 The product must be suitable for installation using standard equipment without additional training.

5.5 COLLABORATOR EVALUATION

As a wheeled mobility aid user with expertise in design and gates, the primary collaborator, Shail Patel, was an ideal candidate to provide an invaluable final evaluation. Further evaluation after the submission with the user group and industry experts is already being set in place.



> ‘The output of this project has well exceeded expectations, due in no small part to Lauren’s technical ability and ease of working with people. At the end of about eight months, Lauren has produced a working prototype of a gate that can be opened without any manual involvement and is stock-proof. Even as proof of principle, this is a major advance that meets a key need. After this project ends, we will continue with testing, further development, and refinement, with the hope that a commercial product along these lines will emerge. This is no small achievement and is greatly appreciated by those of us in the disabled community who would like to access green spaces as easily as non-disabled people. All in all, a great success.’

SHAIL PATEL
Leader, Accessible Gates Workshop

5.6 LIMITATIONS & FUTURE DEVELOPMENTS

Although this university project is coming to an end, this project does not end with this submission. The author plans to continue with the development of the gate past the confines of this report to improve access further and make an impact.

AESTHETICS, TOUCHPOINTS AND SIGNAGE
Unfortunately, within the limits of the project, the signage was not developed to create a visual indication of where the magnet is within the gate, to aid with lining up with the gate correctly and to make users aware of the magnet in case of pacemakers. This could be done with a yellow painted section on the plate, but further development of this would be needed. Also, creating a sign similar to the easy latch sign gives additional guidance to users who may not be sure what to do with it.

FULL-SCALE INSTALLATION AND USER TESTING
Before the next Gates Workshop in August, the author plans to prototype a full-scale version of the concept (based on the life-size sectional rig), which will be installed on a blank easy latch gate provided by Centrewire at the Centre for Outdoor Accessibility. This will allow for testing of the prototype in its intended environment, with wheeled mobility aids by the Accessible Gates Workshop members, with eventual user testing with other participants within the user group.

Figure 72. Centre for Outdoor Accessibility Training (Natural England, 2023)

VEHICLE ATTACHMENTS
Although this would initially be rolled out for use with tramper mobility scooters, significant scope is left for developing attachments for other vehicles and for handheld or pole attachments. Further development could also be done into the aesthetics of the attachment to make them more appealing, not just utilitarian. There is also space to explore using standard parts for the attachment to reduce the need for additional tooling costs.

ENGINEERING AND MANUFACTURING WITH CENTREWIRE
In the short term, the author plans to work with Centrewire to produce a welded version of the prototype to replace the initial installation at the COAT. In the long term, to work with their engineers to test and improve the strength and durability of the frame. In addition, further testing with magnets should be conducted, including looking at magnets with similar strengths but with a larger surface area to make lining up with the blocker easier. If all goes well, this will hopefully end in the production of the first batch of gates.

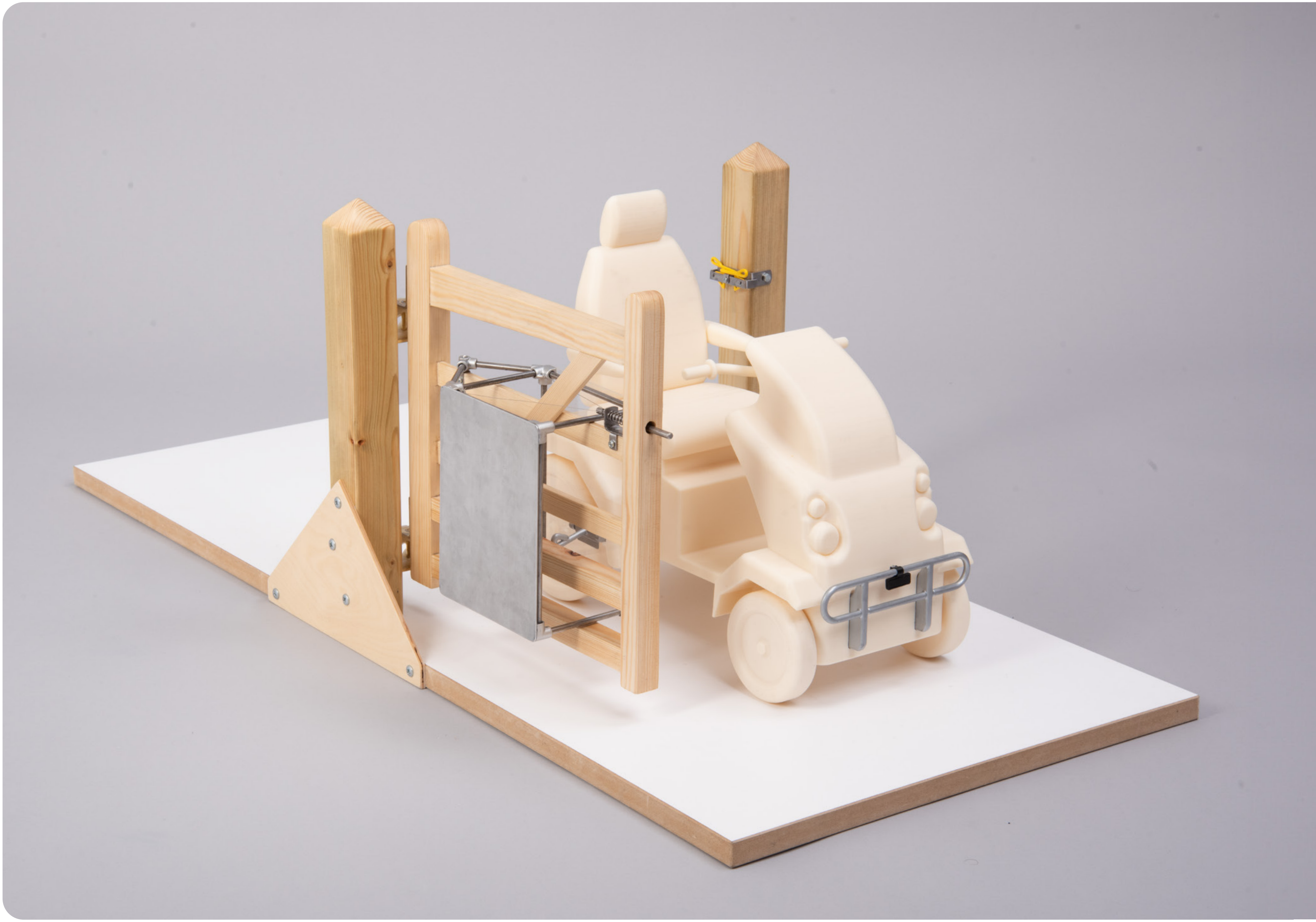
BETA ROLL OUT
The Accessible Gates Workshop team is already in contact with Natural England and the National Trust. In the long term, they hope to do an initial beta roll-out at a few of their sites. The National Trust is an ideal choice, as they rent out tramper vehicles for use in the parks, which would make it straightforward to implement.

5.7 CONCLUSION

This project achieved its aims of following a participatory design process to improve the accessibility of the countryside by creating a gate that could be opened independently and hands free by wheeled mobility aid users. The final design fulfils these requirements in a low cost and low tech solution which is suitable for the outdoor environment. This was achieved through collaboration directly with the key user group and other key stakeholders providing great insight into their perspectives and through preliminary prototyping and a full scale test rig. The author feels they learnt so much from this project and working within the team and listening to new perspectives. They also developed their design, prototyping and academic skills. The primary collaborator and the Accessible Gates Workshop as a whole are very happy with the concept and prototypes and eager to see its development continue.

This project pushed the abilities of the author out of their comfort zone into a heavily mechanism based project but it was handled well and helped them strive for something bigger than usual despite personal physical and mental health struggles. This was a very ambitious brief to take on within the short time frame of this project so there are many areas for future exploration after the deadline including setting up a full scale test rig at the COAT and testing this with the user group.

There is still much work to be done with accessibility but the progress is huge. So much scope left with tit that the author hopes to continue with but also hopes others will take on after. Improving access to information was not as much of a key focus as the author would have liked but they hope that at the very least this project can shine a light on the current issues faced by individuals with mobility challenges and also maybe even encourage more people got get out into the countryside to go out more and show what is possible.



BACK MATTER

6

6.1 REFERENCES

Adams, S.K. (2006) Disability, Access and Design: A Study of Wheelchair Access . Doctor of Philosophy. Bournemouth University.

Aguilar-Carrasco, M.J., Gielen, E., Valles-Planells, M., Galiana, F. and Riutort-Mayol, G. (2023) 'Assessment of barriers for people with disability to enjoy national parks', Frontiers in psychology, 13, pp. 1058647 Available at: 10.3389/fpsyg.2022.1058647.

Aguilar-Carrasco, M.J., Gielen, E., Vallés-Planells, M., Galiana, F. and Riutort-Mayol, G. (2023) 'Assessment of barriers for people with disability to enjoy national parks', Frontiers in Psychology, 13, pp. 1058647 Available at: 10.3389/fpsyg.2022.1058647.

Anon (2023) Sheep repellent wanted. Available at: https://forum.caithness.org/showthread.php?67206-Sheep-repellent-wanted (Accessed: Nov 18, 2023).

Argability. (2023) 'National AgrAbility Project – AgrAbility enhances the quality of life for farmers, ranchers, and other agricultural workers with disabilities, such as spinal cord injuries and amputations, AgrAbility addresses not only these but also many other conditions, such as arthritis, back impairments, and behavioral health issues.', . Available at: http://www.agrability.org/ (Accessed: Nov 23, 2023).

Asghar, S., Edward Torrens, G., Iftikhar, H., Welsh, R. and Harland, R. (2020) 'The influence of social context on the perception of assistive technology: using a semantic differential scale to compare young adults' views from the United Kingdom and Pakistan', Disability and rehabilitation: Assistive technology, 15(5), pp. 563-576 Available at: 10.1080/17483107.2019.1646819.

Ash, I. (2005) countryside-for-all-guide. Available at: https://www.pathsforall.org.uk/mediaLibrary/other/english/countryside-for-all-guide.pdf (Accessed: Dec 29, 2023).

Auger, C., PhD, Demers, L., PhD, Gélinas, I., PhD, Miller, W.C., PhD, Jutai, J.W., PhD and Noreau, L., PhD (2010) 'Life-Space Mobility of Middle-Aged and Older Adults at Various Stages of Usage of Power Mobility Devices', Archives of Physical Medicine and Rehabilitation, 91(5), pp. 765-773 Available at: 10.1016/j.apmr.2010.01.018.

Barasona, J.A., VerCauteren, K.C., Saklou, N., Gortazar, C. and Vicente, J. (2013) 'Effectiveness of cattle operated bump gates and exclusion fences in preventing ungulate multi-host sanitary interaction', Preventive veterinary medicine, 111(1-2), pp. 42-50 Available at: 10.1016/j.prevetmed.2013.03.009.

Benjamin, T. (2022) SPOTLIGHT ON: A history of disabled access - the movement to make Britain's buildings more accessible and disability-friendly. Available at: https://www.thebraincharity.org.uk/history-disabled-access/ (Accessed: Nov 2, 2023).

Bindoff, T. (2018) Understanding the British Standard for Gaps Gates and Stiles BS5709:2018 explained. Available at: https://centrewire.com/wp-content/uploads/2019/09/Pittecroft-Trust-BS5709-2018-explained.pdf (Accessed: Nov 26, 2023).

Binnington, C. and Russo, A. (2021) 'Defensive landscape architecture in modern public spaces', Ri-vista.Ricerche per la progettazione del paesaggio, 19(2), pp. 238-255 Available at: 10.36253/rv-11421.

Blom, J.Y., Konggaard, S.P., Larsson, J.G., Nielsen, K., Northeved, A. and Solfjeld, P. (1984) 'Electronic recording of pressure exerted by cows against structures in free-stall housing', Applied animal behaviour science, 13(1-2), pp. 41-46 Available at: 10.1016/0168-1591(84)90050-9.

Borisoff, J.F., Ripat, J. and Chan, F. (2018) 'Seasonal Patterns of Community Participation and Mobility of Wheelchair Users Over an Entire Year', Archives of Physical Medicine and Rehabilitation, 99(8), pp. 1553-1560 Available at: 10.1016/j.apmr.2018.02.011.

Brian, M. and Looper, L. (2011) How Electromagnets Work. Available at: https://www.johnbowne.org/ourpages/auto/2018/5/28/32241532/How%20Electromagnets%20Work%20_%20HowStuffWorks.pdf (Accessed: April 14, 2024).

britishhardwoods (2024) thin-oak-boards. Available at: https://www.britishhardwoods.co.uk/thin-oak-boards-10-pack-2mm.html (Accessed: April 6, 2024).

bumpndrive (2019) Benefits of a Cattle Guard & How It Works with a Bump Gate. Available at: https://bumpndrive.com/benefits-of-a-cattle-guard-how-it-works-with-a-bump-gate/ (Accessed: April 6, 2024).

BumpN'Drive (2019) Would you benefit from a Bump N' Drive bump gate? Available at: https://www.youtube.com/watch?v=mqFYTv6ILlM&t=2s (Accessed: Nov 6, 2023).

Burns, N., Paterson, K. and Watson, N. (2009a) 'An inclusive outdoors? Disabled people’s experiences of countryside leisure services', Leisure Studies, Available at: 10.1080/02614360903071704.

Burns, N., Paterson, K. and Watson, N. (2009b) 'An inclusive outdoors? Disabled people's experiences of countryside leisure services', Leisure studies, 28(4), pp. 403-417 Available at: 10.1080/02614360903071704.

C, W., J, B., S, O. and L, A. (2022) 'Psychological benefits of outdoor physical activity in natural versus urban environments: A systematic review and meta-analysis of experimental studies', Applied psychology. Health and well-being, 14(3) Available at: 10.1111/aphw.12353.

Candiotti, J., Andrea Sundaram, S., Daveler, B., Gebrosky, B., Grindle, G., Wang, H. and Cooper, R.A. (2017) 'Kinematics and stability analysis of a novel power wheelchair when traversing architectural barriers', Topics in spinal cord injury rehabilitation, 23(2), pp. 110-119 Available at: 10.1310/sci2302-110.

Centrewire (2024a) Installation Instructions 2 Way Easy Latch Hinge Kit - Timber Gates. Available at: https://centrewire.com/wp-content/uploads/2015/09/EASY-LATCH-INSTRUCTIONS-2-way-1.pdf (Accessed: April 6, 2024).

Centrewire (2024b) Welcome to Centrewire. Available at: https://centrewire.com/ (Accessed: Apr 29, 2024).

Centrewire (2015) EASY-LATCH-INSTRUCTIONS-2-way-1.pdf. Available at: https://centrewire.com/wp-content/uploads/2015/09/EASY-LATCH-INSTRUCTIONS-2-way-1.pdf (Accessed: Apr 5, 2024).

Chou, D. and Welch, J. (2024) Bump Gate. Available at: http://uofaagrabilityproject.weebly.com/bump-gate.html (Accessed: Jan 10, 2024).

conservationevidence (2023) Install one-way gates or other structures to allow wildlife to leave roadways - Conservation Evidence. Available at: https://www.conservationevidence.com/actions/2558 (Accessed: Nov 2, 2023).

Cottrell, S. (2014) Dissertations and project reports: a step by step guide. Hampshire, [England]; New York, New York: Palgrave Macmillan.

Disablity Rights (2014) Independent Living | Disability Rights UK. Available at: https://www.disabilityrightsuk.org/resources/independent-living (Accessed: Nov 22, 2023).

Drainey, N. (2011) 'Wheelchair rambler', Scots magazine (Dundee), 174(5), pp. 16.

Fieldfare (2003) Accessibility Standards. Available at: http://www.eau.ee/~bell/Recreation_course%202008-9/Countryside%20for%20All/Accessibility%20Standards.pdf (Accessed: Jan 2, 2024).

Flanagan, E. (2017) Opening up the Yorkshire countryside to wheelchair-users. Available at: https://go.exlibris.link/pcM03dP1 (Accessed: Dec 6, 2023).

ForestryEngland (2023) Easy access trails. Available at: https://www.forestryengland.uk/activities/easy-access-trails (Accessed: Nov 27, 2023).

Frank, A., Neophytou, C., Frank, J. and De Souza, L. (2010) 'Electric Powered Indoor/outdoor Wheelchairs (EPIOCs): Users views of influence on family, friends and carers', Disability and rehabilitation. Assistive technology, 5, pp. 327-38 Available at: 10.3109/17483101003746352.

Gleave, S. and Halden, D. (2001) application-of-accessibility-methodologies-to-land-use-planning. Available at: https://www.gov.wales/sites/default/files/publications/2018-10/application-of-accessibility-methodologies-to-land-use-planning.pdf (Accessed: Jan 2, 2024).

GOV (2024) Livestock populations in the United Kingdom at 1 December. Available at: https://www.gov.uk/government/statistics/livestock-populations-in-the-united-kingdom/livestock-populations-in-the-united-kingdom-at-1-december--2 (Accessed: April 6, 2024).

GOV (2023a) Agricultural Land Use in United Kingdom at 1 June 2023. Available at: https://www.gov.uk/government/statistics/agricultural-land-use-in-the-united-kingdom/agricultural-land-use-in-united-kingdom-at-1-june-2023#:~:text=The%20utilised%20agricultural%20area%20(UAA,third%20(36%25)%20of%20UAA. (Accessed: .

GOV (2023b) Common land guidance sheet 10: highways and cattle grids. Available at: https://www.gov.uk/government/publications/common-land-guidance-sheet-10-highways-and-cattle-grids#:~:text=Obstructing%20a%20footpath%20or%20bridleway,on%20a%20footpath%20or%20bridleway. (Accessed: April 6, 2024).

GOV (2023c) Use of Public Rights of Way. Available at: https://www.gov.uk/right-of-way-open-access-land/use-public-rights-of-way (Accessed: Nov 11, 2023).

Green, M. (2015) Unpowered gate opener animation. Available at: https://www.youtube.com/watch? (Accessed: April 6, 2024).

Hashemi, M. and Karimi, H.A. (2017) 'Collaborative personalized multi-criteria wayfinding for wheelchair users in outdoors', Transactions in GIS, 21(4), pp. 782-795 Available at: 10.1111/tgis.12230.

Horn, M., Smith, J.(.p., Runnalls, J., Sheehan, K., Centre for Accessible Environments (London, E., Habinteg Housing Association and Royal College of Occupational Therapists. Specialist Section - Housing (2018) Wheelchair housing design guide. Third edn. London: RIBA Publishing.

Jool (2024) Safety Magnetic Cabinet Locks. Available at: https://joolbaby.com/products/jool-magnetic-cabinet-safety-locks-set-with-4-locks-1-key-drill-tool-free-baby-childproofing-solution-for-home-ideal-for-all-kitchen-bathroom-cabinets (Accessed: April 6, 2024).

King, C. (1992) 'ADA Presents Door-Opener to Agents', National underwriter (Life, health/financial services ed.), 96(45), pp. 17.

Krueger, K., Esch, L. and Byrne, R. (2019) 'Animal behaviour in a human world: A crowdsourcing study on horses that open door and gate mechanisms', PLoS ONE, 14(6), pp. e0218954 Available at: 10.1371/journal.pone.0218954.

Lance, M. (2023) Alternatives to Cattle Guards. Available at: https://www.ehow.co.uk/info_8630593_alternatives-cattle-guards.html (Accessed: Nov 17, 2023).

Langdon, P., Lazar, J., Heylighen, A. and Dong, H. (2018) 'Breaking Down Barriers: Promoting a New Look at Dementia-Friendly Design'Breaking Down Barriers Switzerland: Springer International Publishing AG, pp. 125-133.

Lymperopoulos, P. and Meade, K. (2014; 2015) PathPass: Opening doors for people with disabilities. ICST, pp. 32.

Lymperopoulos, P. and Meade, K. (2014) PathPass: Opening doors for people with disabilities. Piscataway: The Institute of Electrical and Electronics Engineers, Inc. (IEEE), pp. 32.

Magnosphere (2024) WATERPROOF NEODYMIUM MAGNETS WITH PLASTIC COVER AND SEWING IN PVC. Available at: https://www.magnosphere.co.uk/strong-neodymium-magnets/waterproof-neodymium-magnets/ (Accessed: Jan 6, 2024).

Marino, L. and Merskin, D. (2019) 'Intelligence, complexity, and individuality in sheep', Animal sentience, 4(25), pp. 1 Available at: 10.51291/2377-7478.1374.

Mayo Clinic (2023) Pacemaker. Available at: https://www.mayoclinic.org/tests-procedures/pacemaker/about/pac-20384689 (Accessed: Jan 6, 2024).

Video of cow pushing the push gate and using the brush from Cows are highly motivated to access a grooming substrate (2018a) Directed by McConnachie, E., Smid, A.M.C., Thompson, A.J., Weary, D.M., Gaworski, M.A. and Keyserlingk, M.A.G.V. The Royal Society.

McConnachie, E., Smid, A.M.C., Thompson, A.J., Weary, D.M., Gaworski, M.A. and von Keyserlingk, M.A.G. (2018b) 'Cows are highly motivated to access a grooming substrate', Biology Letters, 14(8), pp. 20180303 Available at: 10.1098/rsbl.2018.0303.

MENE (2019) Monitor of Engagement with the Natural Environment – The national survey on people and the natural environment Headline report 2019: Available at: https://assets.publishing.service.gov.uk/media/5d6cd601e5274a170c435365/Monitor_Engagement_Natural_Environment_2018_2019_v2.pdf (Accessed: .

Menzies, A., Mazan, C., Borisoff, J.F., Mattie, J.L. and Mortenson, W.B. (2021) 'Outdoor recreation among wheeled mobility users: perceived barriers and facilitators', Disability and rehabilitation: Assistive technology, 16(4), pp. 384-390 Available at: 10.1080/17483107.2019.1710772.

Moore, L. (2016) 'Efforts are being made to open up the countryside to wheelchair users', Craven Herald & Pioneer (Bradford, England), .

Mortenson, W.B., Miller, B., Mahmood, A., Routhier, F. and Labbe, D. (2020) 'Urban Environmental Barriers and Facilities to Mobility and Participation for Older Mobility Device Users', Innovation in aging, 4(Supplement_1), pp. 476 Available at: 10.1093/geroni/igaa057.1540.

Musselwhite, C. (2021) 'Prioritising transport barriers and enablers to mobility in later life: A case study from Greater Manchester in the United Kingdom', Journal of Transport & Health, 22, pp. 101085 Available at: 10.1016/j.jth.2021.101085.

Natural England (2023) Where can I find out about accessible gates and other infrastructure? Available at: https://www.youtube.com/watch?v=xCq_u6xjUyQ (Accessed: April 6, 2024).

Nix, C. (1986) FROM A WHEELCHAIR, MOST DOORS ARE CLOSED. Available at: https://go.exlibris.link/l32hzyHT (Accessed: Nov 26, 2023).

Participation, E. (1970) Chronically Sick and Disabled Persons Act 1970. Available at: https://www.legislation.gov.uk/ukpga/1970/44/section/20 (Accessed: Nov 27, 2023).

Equality Act 2010 (SI year and number). Available at: https://www.legislation.gov.uk/ukpga/2010/15/section/19 (Accessed: Nov 27, 2023).

Patel, S. (2022) How can a disabled person access the countryside? Available at: https://www.sustrans.org.uk/our-blog/opinion/2022/december/how-can-a-disabled-person-access-the-countryside (Accessed: Nov 27, 2023).

Patel, S., Lyon, R., Andrews, B., Bindoff, T., Wilson, S., Guest, G., Wragg, G., Bedford, M., Payne, L., Horsefiled, A. and Newman, M. (2024) Accessible Gates Workshop Interim Report April 2024. Available at: https://archive.org/details/accessible-gates-workshop-interim-report-april-2024/mode/2up (Accessed: May 2, 2024).

Patel, S., Lyons, R., Andrews, B., Bindoff, T. and Wilson, S. 2023, Accessible Gates Design Workshop 2 (unpublished).

Patel, S. (2022) Not Enough Wheels to Go Around . Online: Disabled Ramblers. Available at: https://disabledramblers.co.uk/wp3/wp-content/uploads/2022/08/NotEnoughWheelsFinal.v.2.2.pdf (Accessed: Nov 11, 2023).

Progressivecattle (2011) New Bump N'Drive gate hits the market. Available at: https://www.agproud.com/articles/50493-new-bump-n-drive-gate-hits-the-market (Accessed: Jan 10, 2024).

Provided by Federal Information & News Dispatch, Inc. 301-429-5944 (2003) ADA AUTOMATIC DOOR OPENER INSTALLATION. Washington: Federal Information & News Dispatch, LLC. Available at: https://go.exlibris.link/f3mBNPGd (Accessed: April 18, 2024).

Ramblers (2023) Disabled access on public rights of way

For people with limited mobility there can be huge barriers to accessing the countryside. . Available at: https://www.ramblers.org.uk/go-walking-hub/disabled-access-public-rights-way (Accessed: Nov 11, 2023).

Ramrod (2023) Ramrod Bumpgate. Available at: http://ramrodbumpgate.com/ (Accessed: Nov 24, 2023).

Ripat, J., Brown, C. and Ethans, K. (2015) 'Barriers to Wheelchair Use in the Winter', Archives of physical medicine and rehabilitation, 96(6), pp. 1117-1122 Available at: 10.1016/j.apmr.2015.01.020.

Rosenberg, D.E., Huang, D.L., Simonovich, S.D. and Belza, B. (2013) 'Outdoor built environment barriers and facilitators to activity among midlife and older adults with mobility disabilities', The Gerontologist, 53(2), pp. 268-279 Available at: 10.1093/geront/gns119.

Rouvier, T., Louessard, A., Simonetti, E., Hybois, S., Bascou, J., Pontonnier, C., Pillet, H. and Sauret, C. (2022) 'Manual wheelchair biomechanics while overcoming various environmental barriers: A systematic review', PLOS ONE, 17(6), pp. e0269657 Available at: 10.1371/journal.pone.0269657.

RS (2024) Aluminium Solid Metal Sheet, 200mm L, 300mm W, 1.2mm Thickness. Available at: https://www.rs-online.vn/p/sic-1050a-aluminium-sheet300x200x1-2mm/ (Accessed: April 15, 2024).

Ruben (2014) A dual input, dual output, mechanical AND Gate animation | 3D CAD Model Library | GrabCAD. Available at: https://grabcad.com/library/a-dual-input-dual-output-mechanical-and-gate-animation-1 (Accessed: Nov 27, 2023).

SensoryTrust (2023) outdoor-accessibility-guidance-18April2023.pdf. Available at: https://www.sensorytrust.org.uk/uploads/documents/outdoor-accessibility-guidance-18April2023.pdf (Accessed: Jan 2, 2024).

Shen, Y. (2023) Magnet Safety Standards & Regulations in the European Union: An Overview. Available at: https://www.compliancegate.com/magnet-regulations-european-union/ (Accessed: April 18, 2024).

Shen, Y. (2023) Magnet Safety Standards & Regulations in the European Union: An Overview. Available at: https://www.compliancegate.com/magnet-regulations-european-union/ (Accessed: Dec 10, 2023).

Simonelli, M. (2017) OzAutogate Powerless Automatic Gate. . Available at: https://www.youtube.com/watch?v=NIpCFwvJKAY&t=15s (Accessed: Jan 8, 2024).

Smith, M., Calder-Dawe, O., Carroll, P., Kayes, N., Kearns, R., (Judy) Lin, E. and Witten, K. (2021) 'Mobility barriers and enablers and their implications for the wellbeing of disabled children and young people in Aotearoa New Zealand: A cross-sectional qualitative study', Wellbeing, space and society, 2, pp. 100028 Available at: 10.1016/j.wss.2021.100028.

Soares Müller, A.P., Goulart Dorneles, V., Ruiz-Padillo, A. and Vieira Romano, F. (2023) 'Sidewalk Assessment from the Perspective of Accessibility: A Systematic Literature Review', Journal of Urban Planning and Development, 149(3) Available at: 10.1061/JUPDDM.UPENG-4412.

Stanford (2024) How to Safely Use Powerful Magnets. Available at: https://www.stanfordmagnets.com/how-to-safely-use-powerful-magnets.html#:~:text=Whether%20the%20magnetic%20field%20is,harmful%20to%20the%20human%20body. (Accessed: April 18, 2024).

storyset (2024) Storyset | Customize, animate and download illustration for free. Available at: https://storyset.com/ (Accessed: Apr 29, 2024).

Terese, L. (2015) 'With Nature and the Outdoors as a Resource:A Case of a One-Footed Elderly Man in a Wheelchair', Physical culture and sport studies and research, 65(1), pp. 24-30 Available at: 10.1515/pcssr-2015-0008.

Torkia, C., Reid, D., Korner-Bitensky, N., Kairy, D., Rushton, P.W., Demers, L. and Archambault, P.S. (2015) 'Power wheelchair driving challenges in the community: a users' perspective', Disability and rehabilitation: Assistive technology, 10(3), pp. 211-215 Available at: 10.3109/17483107.2014.898159.

Tramper (2022) Tramper Brochure , 1st edn, Salisbury: Beamer Limited.

Ward, C. (2020) Does magnetism decay over time? Available at: https://www.newscientist.com/lastword/mg24732911-800-does-magnetism-decay-over-time/ (Accessed: April 6, 2024).

Watson, N. and Woods, B. (2005) 'No Wheelchairs Beyond this Point: A Historical Examination of Wheelchair Access in the Twentieth Century in Britain and America', Social Policy and Society, 4(1), pp. 97-105 Available at: 10.1017/S1474746404002222.

wbdg (2023) History of Accessible Facility Design | WBDG - Whole Building Design Guide. Available at: https://www.wbdg.org/design-objectives/accessible/history-accessible-facility-design (Accessed: Nov 2, 2023).

Welage, N. and Liu, K.P.Y. (2011) 'Wheelchair accessibility of public buildings: a review of the literature', Disability and rehabilitation: Assistive technology, 6(1), pp. 1-9 Available at: 10.3109/17483107.2010.522680.

Wicks, C., Barton, J., Orbell, S. and Andrews, L. (2022) 'Psychological benefits of outdoor physical activity in natural versus urban environments: A systematic review and meta-analysis of experimental studies', Applied psychology : health and well-being, 14(3), pp. 1037-1061 Available at: 10.1111/aphw.12353.

Wilson, N. (2023) Disabled Adventurer | Public Speaker. Available at: https://www.disabledadventurer.com (Accessed: Jan 3, 2024).

Wilson, S., Bindoff, T., Andrews, B. and Patel, S. 2023, Creativity Workshop on Gate Design Book 1: “Open the Funnel” (unpublished).

6.2 GLOSSARY

Terminology Glossary Courtesy of IAE

Glossary of Terms

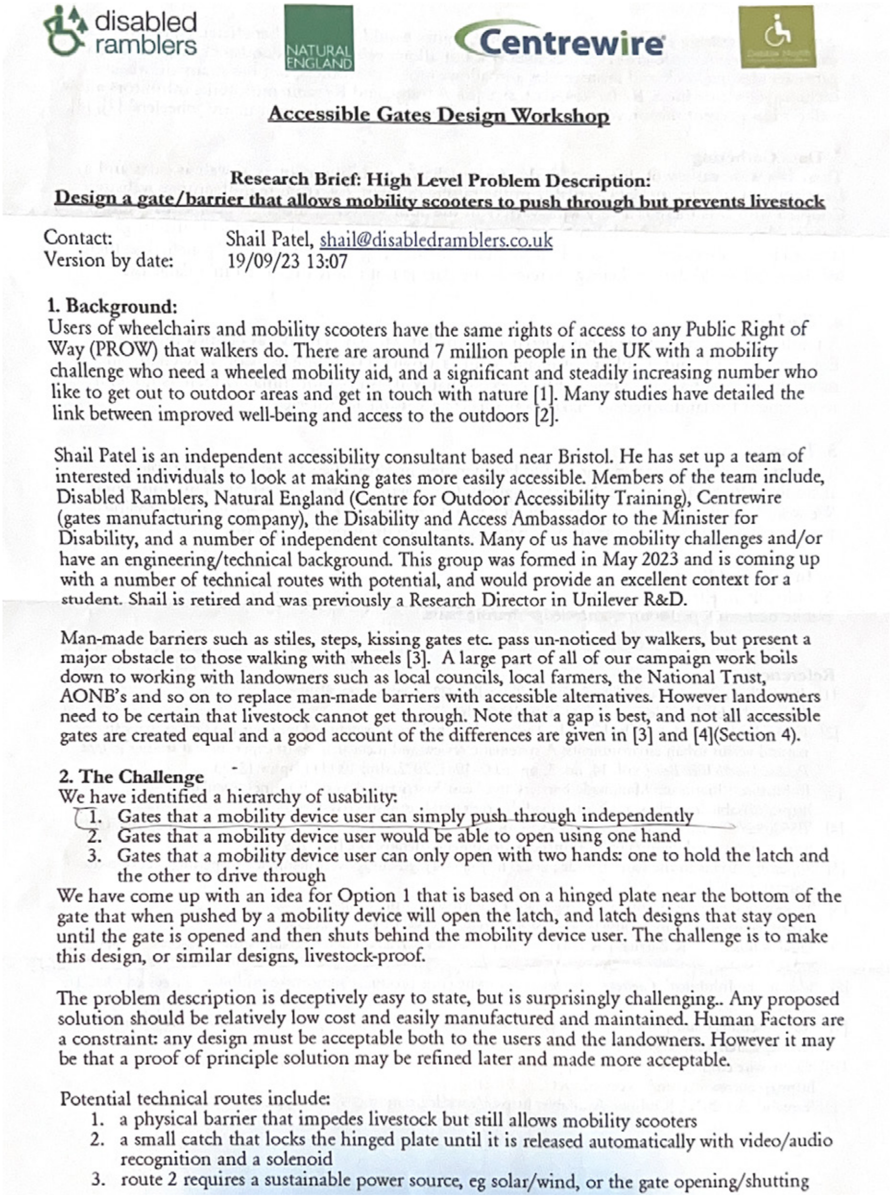
Term	Description
Gate Terminology	
Pedestrian Gate	Device hinged at one side installed in a boundary such as a fence, hedge or wall which acts as a barrier to animals and motor vehicles, but which allows the passage of pedestrians and their dogs, and mobility vehicles.
Bridle Gate	Device hinged at one side installed in a boundary such as a fence, hedge or wall which acts as a barrier to animals and motor vehicles, but which allows the passage of horse-riders, riders of cycles, pedestrians and their dogs, and mobility vehicles (Ref: BS5709)
Bridleway	Any route where horses are allowed
Kissing Gate	Device consisting of a hinged gate that is constrained to swing between two posts at the opening of an enclosure forming part of the structure, and which allows the passage of legitimate users, whilst preventing the passage of animals, etc.
Gate Leaf	The main body/frame/Panel of a gate that opens and closes as a single unit.
Gate Rail	A horizontal section of a gate
Gate Stile	A vertical upright section of a gate, normally the outermost uprights.
Hang Stile	The upright section of the gate where the hinges are fixed and where it connects to the post. (End of the gate that pivots)
Slam Stile	The upright section of the gate where the latch is fixed and which latches closed. (End of the gate that swings)
H-Frame	A Metal frame, in a "H" style arrangement with a section/cross member buried in the ground
Slam Post	The post to which a gate closes to, often where the latching interface occurs.
Hang Post	The post to which a gate is hung, where the hinges are situated
Auto Latch	A latching mechanism that automatically latches closed. In Centrewire terms this is a design of latch that is attached to one side of a post.
Easy Latch	A Centrewire automatically closing latch system that is installed in-line with the gate, between the gate and post.
1-Way Catch	A latching system that allows the gate to be opened only one way in a gap. A 1-way Easy latch simply has one of the pawls removed.
2-Way Catch	A latching system that allows the gate to be opened both ways in a gap. A 2-way Easy Latch system has two Pawls operating in opposing directions.
Auto Latch Pawl	The pawl is the levering section of the latch that once down restrains the movement of the bolt. (The yellow component that is moved by the user in an easy latch)
Shoot Bolt/Spring Bolt	A moveable bolt, normally attached to the gate, to which the latch restrains or which extends into a profile, to prevent the gate being opened . Following the release of BS 5709:2018, these are usually found in a "D-loop" arrangement to reduce risk of catching or harm as users pass through the gate.
Offset Hinge set	Otherwise known as the self-closing hinge set. This only uses the force of gravity to self close, with no hydraulics involved.
Straight Handle	A standard, straight handle supplied with Centrewire gates, protruding a certain height above the top of the gate to allow access to horse riders.
Trombone Handle	A handle that curves over the top of the gate, allowing easy operation
Stock-Proof Handle	A handle whose operation is intended to prevent the passage of farmed animals.
Top Rail Guide Plate	The plate attached to the top rail of a gate, through which the handle passes. Helps to guide and support the handle through its range of motion.
RADAR lock	Lock operated by a key (RADAR Key), normally only available to disabled people
Gate Striker/Cranked Striker	A non-moving length of metal, normally attached to the gate, to which the latch restrains, to prevent the gate being opened. Following the release of BS 5709:2018, these are usually found in a "D-loop" arrangement to reduce risk of catching or harm as users pass through the gate.
Gate Stop	A protrusion on Centrewire gates to convert a gate to be only 1-way. It closes onto the post, normally with a rubber dampener preventing the gate going through (used in conjunction with a 1-way Easy latch)
Hinge Hook	A simple pin on a piece of plate that provides the male portion of a hinge on a post for an eyebolt on a gate assembly to mount to.
Hook to Drive	A hinge hook attached to a sharpened pin to be driven into a wooden post
Hook to Bolt	A hinge hook with a threaded section of rod attached, to allow it to be mounted through a hole in a post and fixed in place with a nut.
Hook to Plate	A hinge hook with a plate with multiple holes for bolts to pass through
Double Strap Bands	A piece of plate, that mounts either side of and can be bolted to a wooden gate, which is formed to provide the female profile of a hinge on its end, to mount to a hinge hook.
Dog Gate	Device allowing the passage of a dog, whilst preventing the passage of other animals
Enclosure	Area within which the gate of a kissing gate swings or the area between a part of gates comprising one structure
Gap	Unimpeded way through a boundary together with any side structure
Self-closing gate	Gate which returns without intervention to a position touching, or in line with, the closing post
Horse Stile	Non-moving structure designed to allow horses to pass whilst forming a deterrent to motorcycles
Stepover	Rail in a horse stile, on the ground surface, which horses need to step over
Step-through gate	Openable barrier allowing horses to step through when closed. (Also known as a horse-friendly barrier

sales@iae.co.uk
+44(0)1782 339320
Mossfield Road, Adderley Green, Longton, Stoke-on-Trent, ST3 5BW
www.iae.co.uk
@IAE1969
Reg.No 1448116 Proprietors : F. Klucznik & Son Ltd.

Pedestrian/Access Stile	Fixed device allowing the passage of pedestrians over or through a fence, wall or hedge, while forming a barrier to farmed animals and many dogs, as well as cycles and mobility vehicles.
General Manufacturing Terminology	
SHS	Square Hollow Section Tube
RHS	Rectangular Hollow Section Tube
CHS	Circular Hollow Section Tube
Galv Venting/Notching	Holes or profiles added to a structure or section of tube, to prevent air traps which could be dangerous when dipped in a galvanising bath.
Tube Saddling	The profiling of the end of a tube where it meets another tube.

6.3 APPENDICES

APPENDIX A: COLLABORATIVE BRIEF



Accessible Gates Design Workshop

Research Brief: High Level Problem Description:
Design a gate/barrier that allows mobility scooters to push through but prevents livestock

Contact: Shail Patel, shail@disabledramblers.co.uk
Version by date: 19/09/23 13:07

1. Background:
Users of wheelchairs and mobility scooters have the same rights of access to any Public Right of Way (PROW) that walkers do. There are around 7 million people in the UK with a mobility challenge who need a wheeled mobility aid, and a significant and steadily increasing number who like to get out to outdoor areas and get in touch with nature [1]. Many studies have detailed the link between improved well-being and access to the outdoors [2].

Shail Patel is an independent accessibility consultant based near Bristol. He has set up a team of interested individuals to look at making gates more easily accessible. Members of the team include, Disabled Ramblers, Natural England (Centre for Outdoor Accessibility Training), Centrewire (gates manufacturing company), the Disability and Access Ambassador to the Minister for Disability, and a number of independent consultants. Many of us have mobility challenges and/or have an engineering/technical background. This group was formed in May 2023 and is coming up with a number of technical routes with potential, and would provide an excellent context for a student. Shail is retired and was previously a Research Director in Unilever R&D.

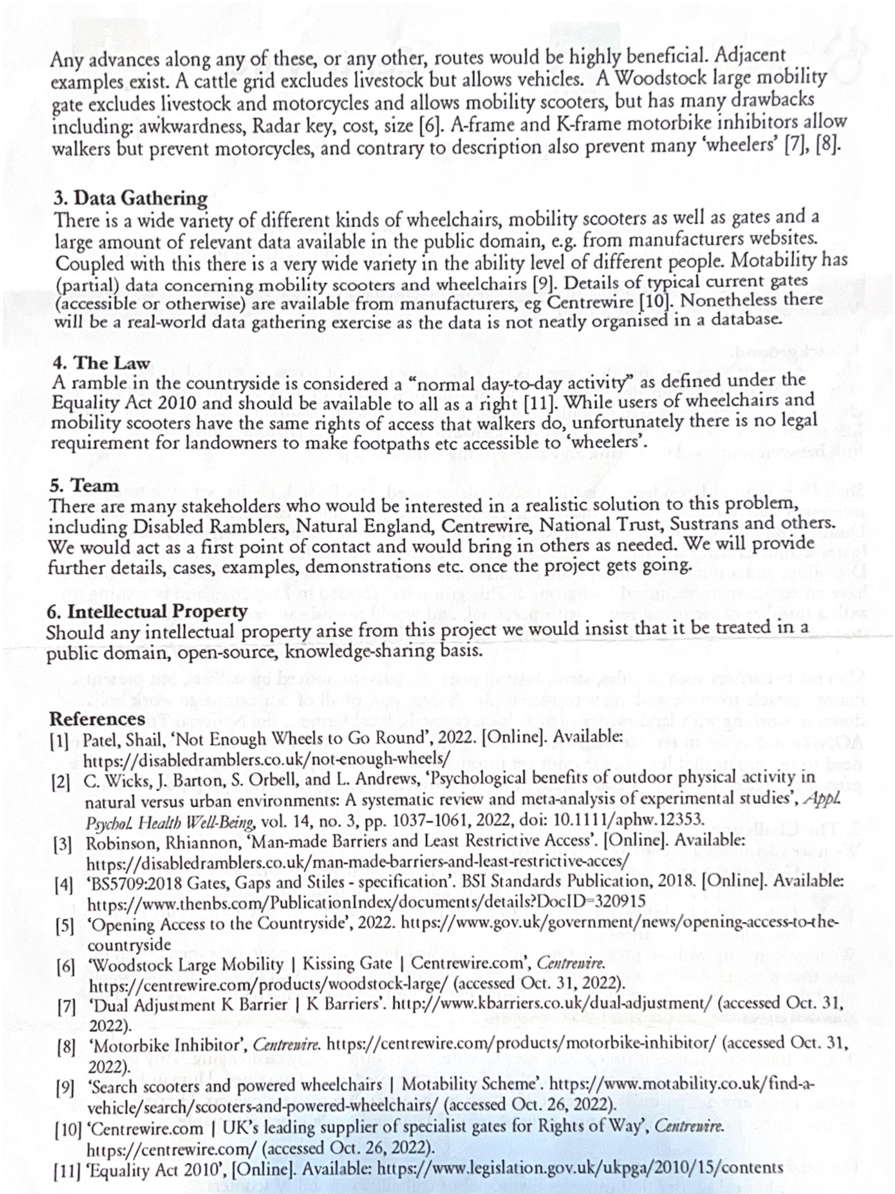
Man-made barriers such as stiles, steps, kissing gates etc. pass un-noticed by walkers, but present a major obstacle to those walking with wheels [3]. A large part of all of our campaign work boils down to working with landowners such as local councils, local farmers, the National Trust, AONB's and so on to replace man-made barriers with accessible alternatives. However landowners need to be certain that livestock cannot get through. Note that a gap is best, and not all accessible gates are created equal and a good account of the differences are given in [3] and [4](Section 4).

2. The Challenge
We have identified a hierarchy of usability:
1. Gates that a mobility device user can simply push through independently
2. Gates that a mobility device user would be able to open using one hand
3. Gates that a mobility device user can only open with two hands: one to hold the latch and the other to drive through

We have come up with an idea for Option 1 that is based on a hinged plate near the bottom of the gate that when pushed by a mobility device will open the latch, and latch designs that stay open until the gate is opened and then shuts behind the mobility device user. The challenge is to make this design, or similar designs, livestock-proof.

The problem description is deceptively easy to state, but is surprisingly challenging.. Any proposed solution should be relatively low cost and easily manufactured and maintained. Human Factors are a constraint: any design must be acceptable both to the users and the landowners. However it may be that a proof of principle solution may be refined later and made more acceptable.

Potential technical routes include:
1. a physical barrier that impedes livestock but still allows mobility scooters
2. a small catch that locks the hinged plate until it is released automatically with video/audio recognition and a solenoid
3. route 2 requires a sustainable power source, eg solar/wind, or the gate opening/shutting



Any advances along any of these, or any other, routes would be highly beneficial. Adjacent examples exist. A cattle grid excludes livestock but allows vehicles. A Woodstock large mobility gate excludes livestock and motorcycles and allows mobility scooters, but has many drawbacks including: awkwardness, Radar key, cost, size [6]. A-frame and K-frame motorbike inhibitors allow walkers but prevent motorcycles, and contrary to description also prevent many 'wheelers' [7], [8].

3. Data Gathering
There is a wide variety of different kinds of wheelchairs, mobility scooters as well as gates and a large amount of relevant data available in the public domain, e.g. from manufacturers websites. Coupled with this there is a very wide variety in the ability level of different people. Motability has (partial) data concerning mobility scooters and wheelchairs [9]. Details of typical current gates (accessible or otherwise) are available from manufacturers, eg Centrewire [10]. Nonetheless there will be a real-world data gathering exercise as the data is not neatly organised in a database.

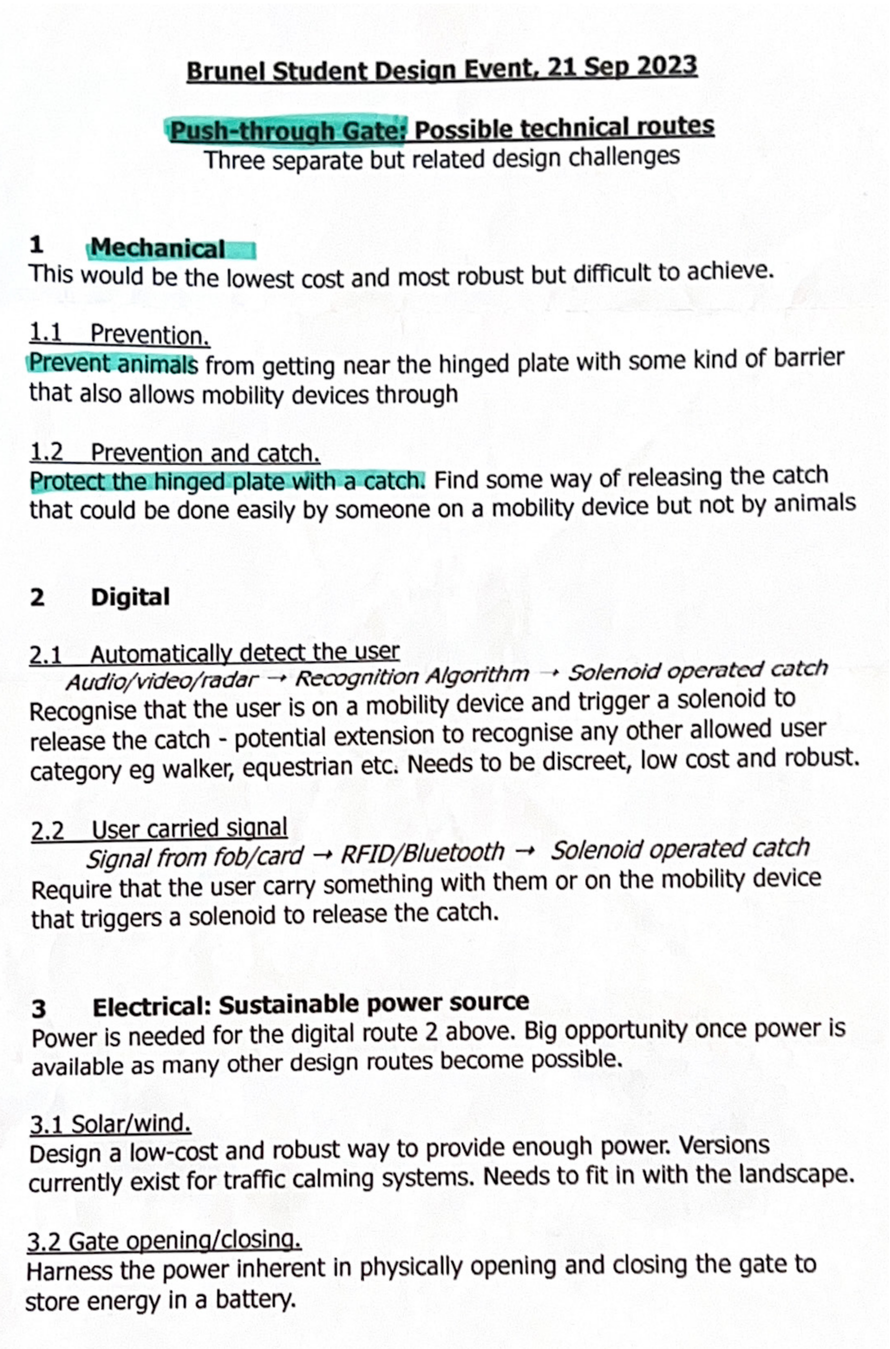
4. The Law
A ramble in the countryside is considered a "normal day-to-day activity" as defined under the Equality Act 2010 and should be available to all as a right [11]. While users of wheelchairs and mobility scooters have the same rights of access that walkers do, unfortunately there is no legal requirement for landowners to make footpaths etc accessible to 'wheelers'.

5. Team
There are many stakeholders who would be interested in a realistic solution to this problem, including Disabled Ramblers, Natural England, Centrewire, National Trust, Sustrans and others. We would act as a first point of contact and would bring in others as needed. We will provide further details, cases, examples, demonstrations etc. once the project gets going.

6. Intellectual Property
Should any intellectual property arise from this project we would insist that it be treated in a public domain, open-source, knowledge-sharing basis.

References

[1] Patel, Shail, 'Not Enough Wheels to Go Round', 2022. [Online]. Available: https://disabledramblers.co.uk/not-enough-wheels/
[2] C. Wicks, J. Barton, S. Orbell, and L. Andrews, 'Psychological benefits of outdoor physical activity in natural versus urban environments: A systematic review and meta-analysis of experimental studies', *Appl. Psychol. Health Well-Being*, vol. 14, no. 3, pp. 1037–1061, 2022, doi: 10.1111/aphw.12353.
[3] Robinson, Rhiannon, 'Man-made Barriers and Least Restrictive Access'. [Online]. Available: https://disabledramblers.co.uk/man-made-barriers-and-least-restrictive-acces/
[4] 'BS5709:2018 Gates, Gaps and Stiles - specification'. BSI Standards Publication, 2018. [Online]. Available: https://www.thenbs.com/PublicationIndex/documents/details?DocID=320915
[5] 'Opening Access to the Countryside', 2022. https://www.gov.uk/government/news/opening-access-to-the-countryside
[6] 'Woodstock Large Mobility | Kissing Gate | Centrewire.com', *Centrewire*. https://centrewire.com/products/woodstock-large/ (accessed Oct. 31, 2022).
[7] 'Dual Adjustment K Barrier | K Barriers'. http://www.kbarriers.co.uk/dual-adjustment/ (accessed Oct. 31, 2022).
[8] 'Motorbike Inhibitor', *Centrewire*. https://centrewire.com/products/motorbike-inhibitor/ (accessed Oct. 31, 2022).
[9] 'Search scooters and powered wheelchairs | Motability Scheme'. https://www.motability.co.uk/find-a-vehicle/search/scooters-and-powered-wheelchairs/ (accessed Oct. 26, 2022).
[10] 'Centrewire.com | UK's leading supplier of specialist gates for Rights of Way', *Centrewire*. https://centrewire.com/ (accessed Oct. 26, 2022).
[11] 'Equality Act 2010', [Online]. Available: https://www.legislation.gov.uk/ukpga/2010/15/contents



Brunel Student Design Event, 21 Sep 2023

Push-through Gate: Possible technical routes

Three separate but related design challenges

1 Mechanical

This would be the lowest cost and most robust but difficult to achieve.

1.1 Prevention.

Prevent animals from getting near the hinged plate with some kind of barrier that also allows mobility devices through

1.2 Prevention and catch.

Protect the hinged plate with a catch. Find some way of releasing the catch that could be done easily by someone on a mobility device but not by animals

2 Digital

2.1 Automatically detect the user

Audio/video/radar → Recognition Algorithm → Solenoid operated catch

Recognise that the user is on a mobility device and trigger a solenoid to release the catch - potential extension to recognise any other allowed user category eg walker, equestrian etc. Needs to be discreet, low cost and robust.

2.2 User carried signal

Signal from fob/card → RFID/Bluetooth → Solenoid operated catch

Require that the user carry something with them or on the mobility device that triggers a solenoid to release the catch.

3 Electrical: Sustainable power source

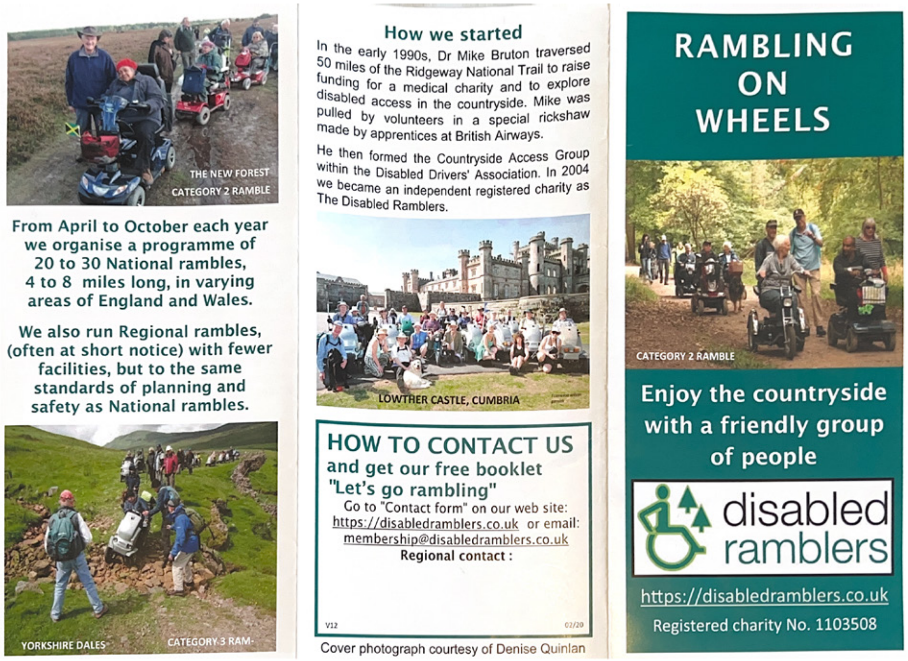
Power is needed for the digital route 2 above. Big opportunity once power is available as many other design routes become possible.

3.1 Solar/wind.

Design a low-cost and robust way to provide enough power. Versions currently exist for traffic calming systems. Needs to fit in with the landscape.

3.2 Gate opening/closing.

Harness the power inherent in physically opening and closing the gate to store energy in a battery.



THE NEW FOREST
CATEGORY 2 RAMBLE

From April to October each year we organise a programme of 20 to 30 National rambles, 4 to 8 miles long, in varying areas of England and Wales.

We also run Regional rambles, (often at short notice) with fewer facilities, but to the same standards of planning and safety as National rambles.

YORKSHIRE DALES
CATEGORY 3 RAM-

How we started

In the early 1990s, Dr Mike Bruton traversed 50 miles of the Ridgeway National Trail to raise funding for a medical charity and to explore disabled access in the countryside. Mike was pulled by volunteers in a special rickshaw made by apprentices at British Airways.

He then formed the Countryside Access Group within the Disabled Drivers' Association. In 2004 we became an independent registered charity as The Disabled Ramblers.

LOWTHER CASTLE, CUMBRIA

HOW TO CONTACT US
and get our free booklet
"Let's go rambling"
Go to "Contact form" on our web site:
https://disabledramblers.co.uk or email:
membership@disabledramblers.co.uk
Regional contact :

V12 02/20

Cover photograph courtesy of Denise Quinlan

RAMBLING ON WHEELS

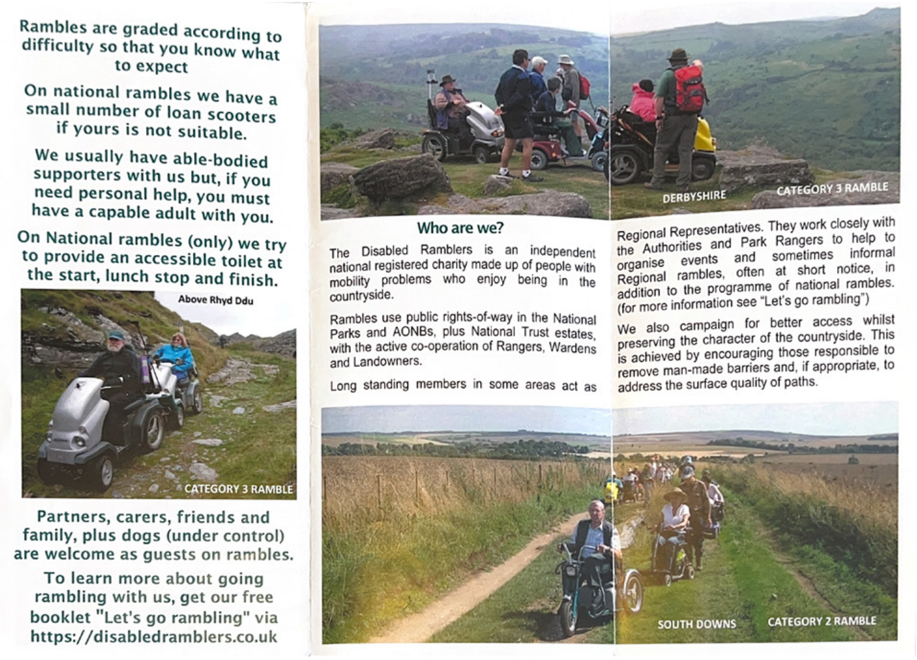
CATEGORY 2 RAMBLE

Enjoy the countryside with a friendly group of people

disabled ramblers

https://disabledramblers.co.uk

Registered charity No. 1103508



Rambles are graded according to difficulty so that you know what to expect

On national rambles we have a small number of loan scooters if yours is not suitable.

We usually have able-bodied supporters with us but, if you need personal help, you must have a capable adult with you.

On National rambles (only) we try to provide an accessible toilet at the start, lunch stop and finish.

Above Rhyd Ddu

CATEGORY 3 RAMBLE

Partners, carers, friends and family, plus dogs (under control) are welcome as guests on rambles.

To learn more about going rambling with us, get our free booklet "Let's go rambling" via https://disabledramblers.co.uk

DERBYSHIRE
CATEGORY 3 RAMBLE

Who are we?

The Disabled Ramblers is an independent national registered charity made up of people with mobility problems who enjoy being in the countryside.

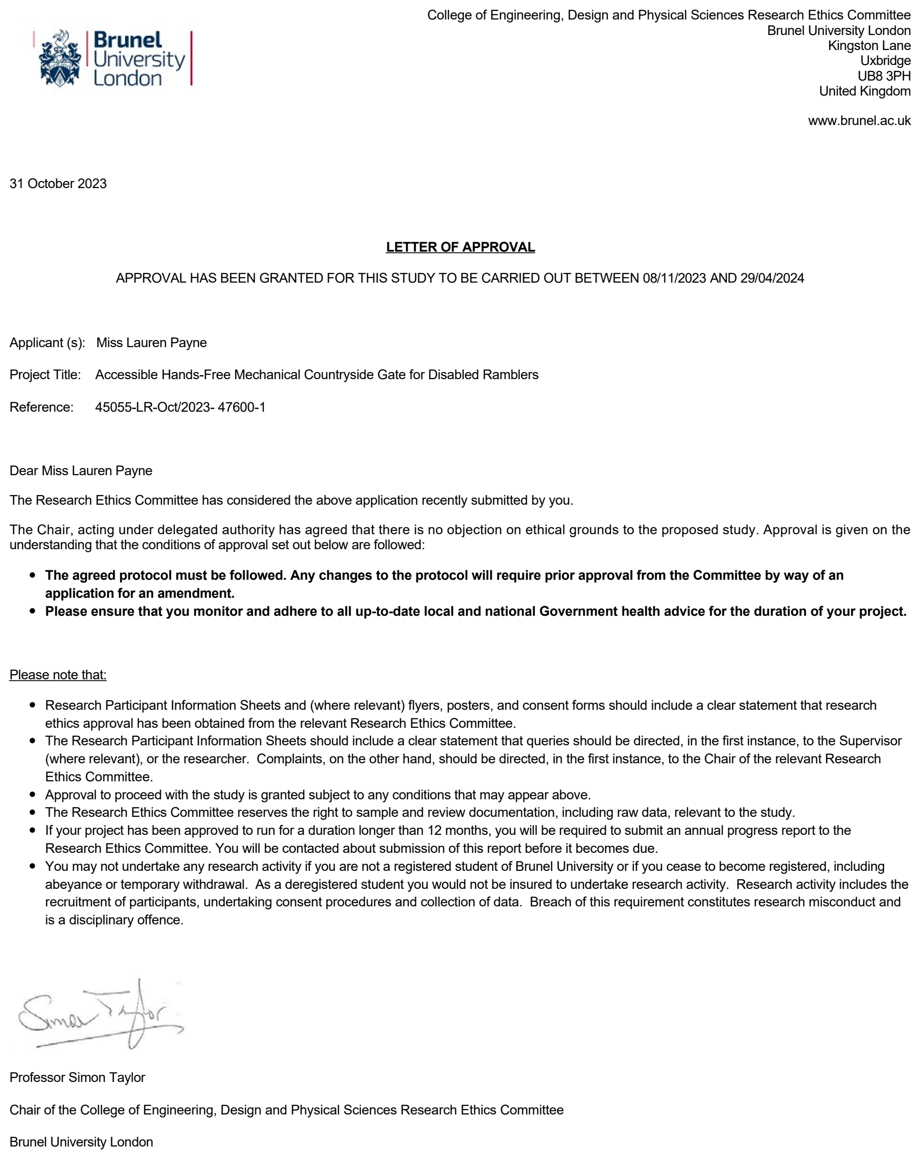
Rambles use public rights-of-way in the National Parks and AONBs, plus National Trust estates, with the active co-operation of Rangers, Wardens and Landowners.

Long standing members in some areas act as Regional Representatives. They work closely with the Authorities and Park Rangers to help to organise events and sometimes informal Regional rambles, often at short notice, in addition to the programme of national rambles. (for more information see "Let's go rambling")

We also campaign for better access whilst preserving the character of the countryside. This is achieved by encouraging those responsible to remove man-made barriers and, if appropriate, to address the surface quality of paths.

SOUTH DOWNS
CATEGORY 2 RAMBLE

APPENDIX B: ETHICS APPROVAL LETTERS



College of Engineering, Design and Physical Sciences Research Ethics Committee
Brunel University London
Kingston Lane
Uxbridge
UB8 3PH
United Kingdom

www.brunel.ac.uk

31 October 2023

LETTER OF APPROVAL

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 08/11/2023 AND 29/04/2024

Applicant (s): Miss Lauren Payne

Project Title: Accessible Hands-Free Mechanical Countryside Gate for Disabled Ramblers

Reference: 45055-LR-Oct/2023- 47600-1

Dear Miss Lauren Payne

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- **The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.**
- **Please ensure that you monitor and adhere to all up-to-date local and national Government health advice for the duration of your project.**

Please note that:

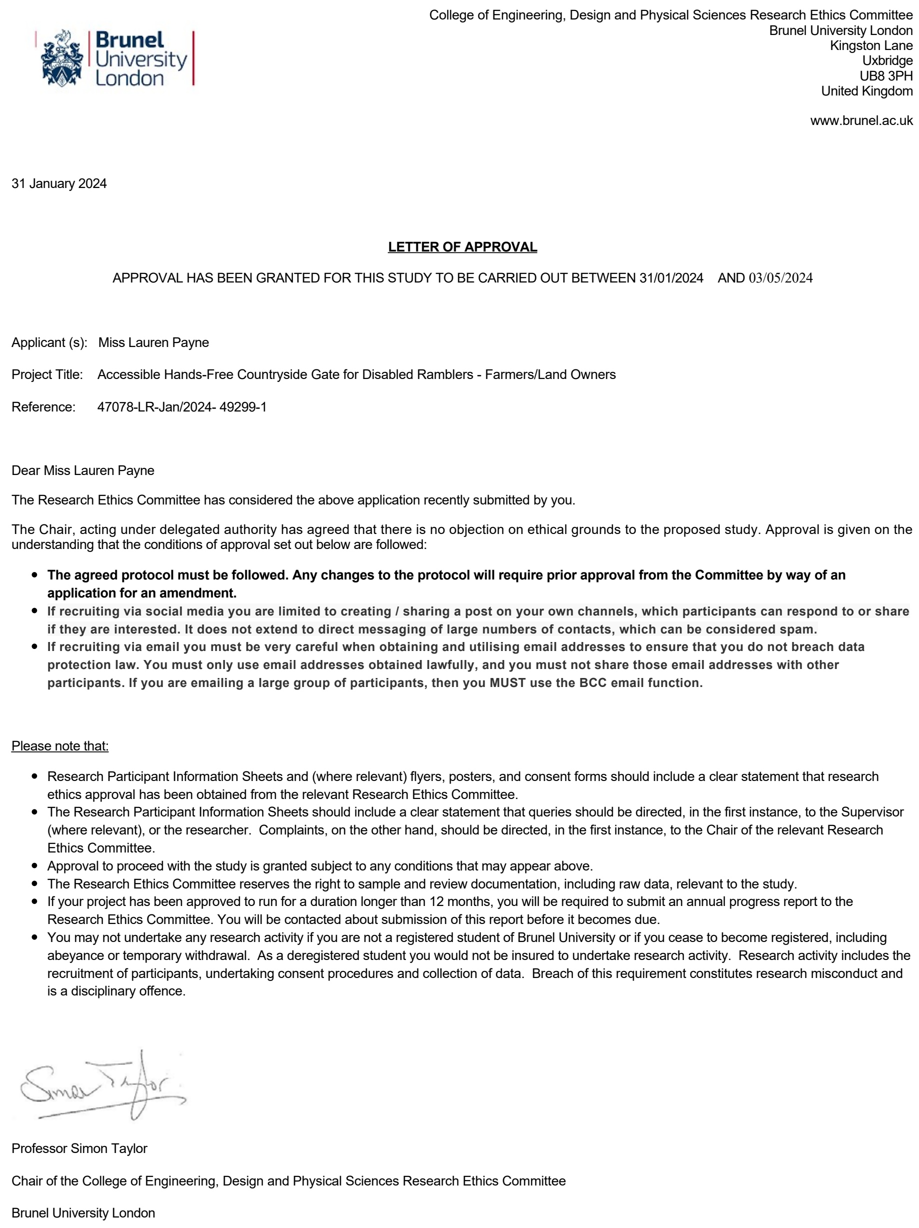
- Research Participant Information Sheets and (where relevant) flyers, posters, and consent forms should include a clear statement that research ethics approval has been obtained from the relevant Research Ethics Committee.
- The Research Participant Information Sheets should include a clear statement that queries should be directed, in the first instance, to the Supervisor (where relevant), or the researcher. Complaints, on the other hand, should be directed, in the first instance, to the Chair of the relevant Research Ethics Committee.
- Approval to proceed with the study is granted subject to any conditions that may appear above.
- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the study.
- If your project has been approved to run for a duration longer than 12 months, you will be required to submit an annual progress report to the Research Ethics Committee. You will be contacted about submission of this report before it becomes due.
- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.

Simon Taylor

Professor Simon Taylor

Chair of the College of Engineering, Design and Physical Sciences Research Ethics Committee

Brunel University London



College of Engineering, Design and Physical Sciences Research Ethics Committee
Brunel University London
Kingston Lane
Uxbridge
UB8 3PH
United Kingdom

www.brunel.ac.uk

31 January 2024

LETTER OF APPROVAL

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 31/01/2024 AND 03/05/2024

Applicant (s): Miss Lauren Payne

Project Title: Accessible Hands-Free Countryside Gate for Disabled Ramblers - Farmers/Land Owners

Reference: 47078-LR-Jan/2024- 49299-1

Dear Miss Lauren Payne

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- **The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.**
- **If recruiting via social media you are limited to creating / sharing a post on your own channels, which participants can respond to or share if they are interested. It does not extend to direct messaging of large numbers of contacts, which can be considered spam.**
- **If recruiting via email you must be very careful when obtaining and utilising email addresses to ensure that you do not breach data protection law. You must only use email addresses obtained lawfully, and you must not share those email addresses with other participants. If you are emailing a large group of participants, then you MUST use the BCC email function.**

Please note that:

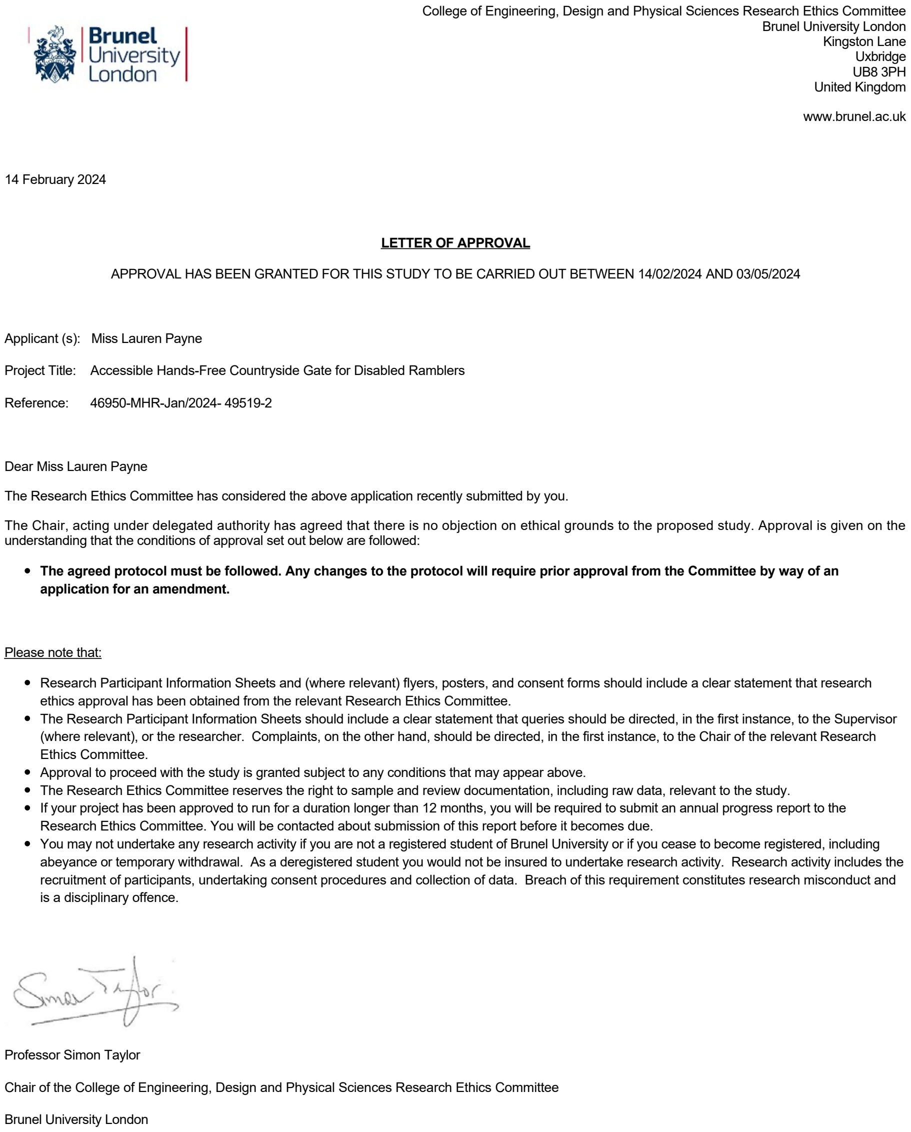
- Research Participant Information Sheets and (where relevant) flyers, posters, and consent forms should include a clear statement that research ethics approval has been obtained from the relevant Research Ethics Committee.
- The Research Participant Information Sheets should include a clear statement that queries should be directed, in the first instance, to the Supervisor (where relevant), or the researcher. Complaints, on the other hand, should be directed, in the first instance, to the Chair of the relevant Research Ethics Committee.
- Approval to proceed with the study is granted subject to any conditions that may appear above.
- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the study.
- If your project has been approved to run for a duration longer than 12 months, you will be required to submit an annual progress report to the Research Ethics Committee. You will be contacted about submission of this report before it becomes due.
- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.

Simon Taylor

Professor Simon Taylor

Chair of the College of Engineering, Design and Physical Sciences Research Ethics Committee

Brunel University London



College of Engineering, Design and Physical Sciences Research Ethics Committee
Brunel University London
Kingston Lane
Uxbridge
UB8 3PH
United Kingdom

www.brunel.ac.uk

14 February 2024

LETTER OF APPROVAL

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 14/02/2024 AND 03/05/2024

Applicant (s): Miss Lauren Payne

Project Title: Accessible Hands-Free Countryside Gate for Disabled Ramblers

Reference: 46950-MHR-Jan/2024- 49519-2

Dear Miss Lauren Payne

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- **The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.**

Please note that:

- Research Participant Information Sheets and (where relevant) flyers, posters, and consent forms should include a clear statement that research ethics approval has been obtained from the relevant Research Ethics Committee.
- The Research Participant Information Sheets should include a clear statement that queries should be directed, in the first instance, to the Supervisor (where relevant), or the researcher. Complaints, on the other hand, should be directed, in the first instance, to the Chair of the relevant Research Ethics Committee.
- Approval to proceed with the study is granted subject to any conditions that may appear above.
- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the study.
- If your project has been approved to run for a duration longer than 12 months, you will be required to submit an annual progress report to the Research Ethics Committee. You will be contacted about submission of this report before it becomes due.
- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.

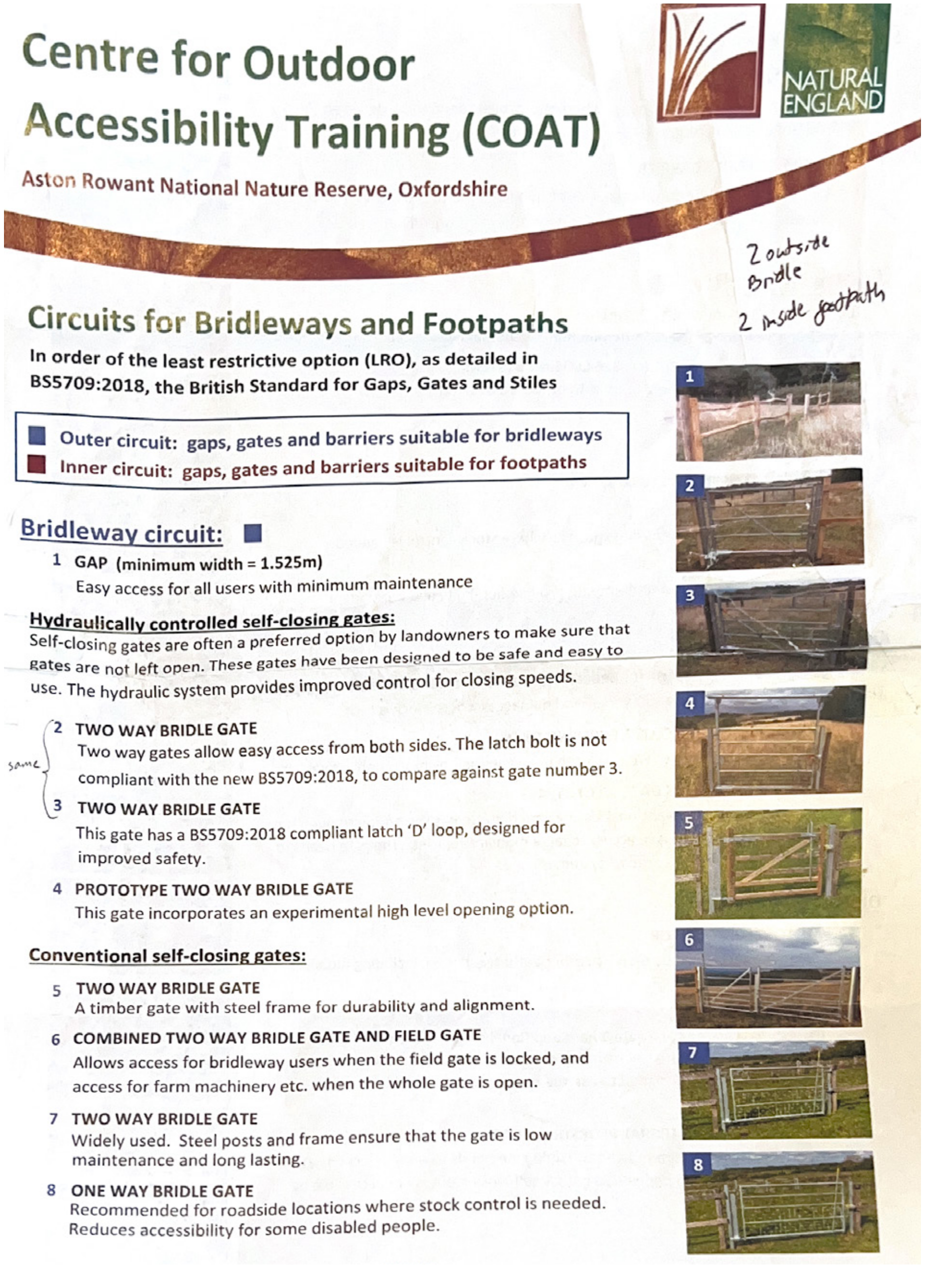
Simon Taylor

Professor Simon Taylor

Chair of the College of Engineering, Design and Physical Sciences Research Ethics Committee

Brunel University London

APPENDIX C: AUTOETHNOGRAPHY



NATURAL ENGLAND

Centre for Outdoor Accessibility Training (COAT)

Aston Rowant National Nature Reserve, Oxfordshire

2 outside Bridle
2 inside footpath

Circuits for Bridleways and Footpaths

In order of the least restrictive option (LRO), as detailed in BS5709:2018, the British Standard for Gaps, Gates and Stiles

🟦 **Outer circuit:** gaps, gates and barriers suitable for bridleways
🟥 **Inner circuit:** gaps, gates and barriers suitable for footpaths

Bridleway circuit: 🟦

1 **GAP (minimum width = 1.525m)**
Easy access for all users with minimum maintenance

Hydraulically controlled self-closing gates:
Self-closing gates are often a preferred option by landowners to make sure that gates are not left open. These gates have been designed to be safe and easy to use. The hydraulic system provides improved control for closing speeds.

same

2 **TWO WAY BRIDLE GATE**
Two way gates allow easy access from both sides. The latch bolt is not compliant with the new BS5709:2018, to compare against gate number 3.

3 **TWO WAY BRIDLE GATE**
This gate has a BS5709:2018 compliant latch 'D' loop, designed for improved safety.

4 **PROTOTYPE TWO WAY BRIDLE GATE**
This gate incorporates an experimental high level opening option.

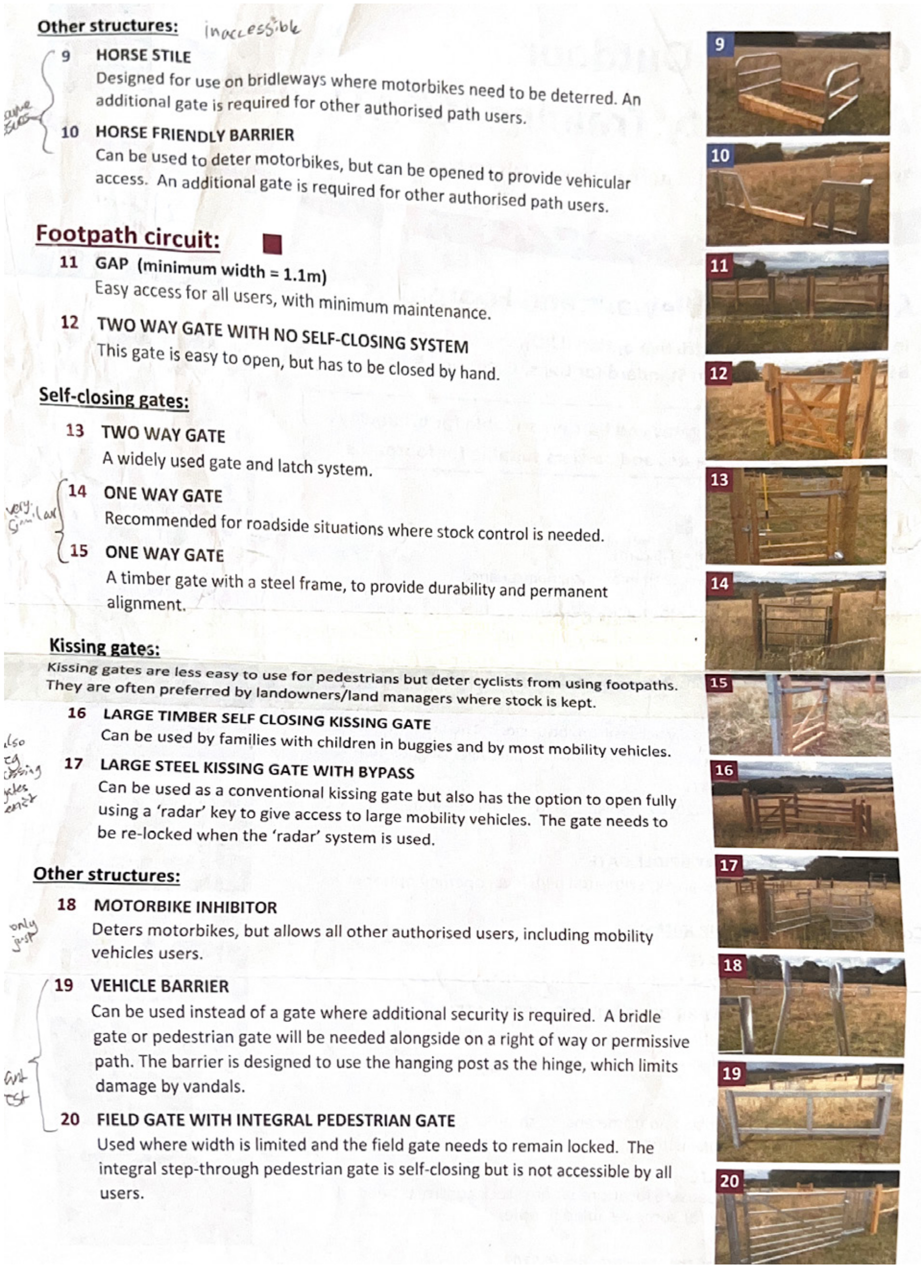
Conventional self-closing gates:

5 **TWO WAY BRIDLE GATE**
A timber gate with steel frame for durability and alignment.

6 **COMBINED TWO WAY BRIDLE GATE AND FIELD GATE**
Allows access for bridleway users when the field gate is locked, and access for farm machinery etc. when the whole gate is open.

7 **TWO WAY BRIDLE GATE**
Widely used. Steel posts and frame ensure that the gate is low maintenance and long lasting.

8 **ONE WAY BRIDLE GATE**
Recommended for roadside locations where stock control is needed. Reduces accessibility for some disabled people.



Other structures: inaccessible

[illegible]

9 **HORSE STILE**
Designed for use on bridleways where motorbikes need to be deterred. An additional gate is required for other authorised path users.

10 **HORSE FRIENDLY BARRIER**
Can be used to deter motorbikes, but can be opened to provide vehicular access. An additional gate is required for other authorised path users.

Footpath circuit: 🟥

11 **GAP (minimum width = 1.1m)**
Easy access for all users, with minimum maintenance.

12 **TWO WAY GATE WITH NO SELF-CLOSING SYSTEM**
This gate is easy to open, but has to be closed by hand.

Self-closing gates:

13 **TWO WAY GATE**
A widely used gate and latch system.

very similar

14 **ONE WAY GATE**
Recommended for roadside situations where stock control is needed.

15 **ONE WAY GATE**
A timber gate with a steel frame, to provide durability and permanent alignment.

Kissing gates:

Kissing gates are less easy to use for pedestrians but deter cyclists from using footpaths. They are often preferred by landowners/land managers where stock is kept.

also eg closing gates entry

16 **LARGE TIMBER SELF CLOSING KISSING GATE**
Can be used by families with children in buggies and by most mobility vehicles.

17 **LARGE STEEL KISSING GATE WITH BYPASS**
Can be used as a conventional kissing gate but also has the option to open fully using a 'radar' key to give access to large mobility vehicles. The gate needs to be re-locked when the 'radar' system is used.

Other structures:

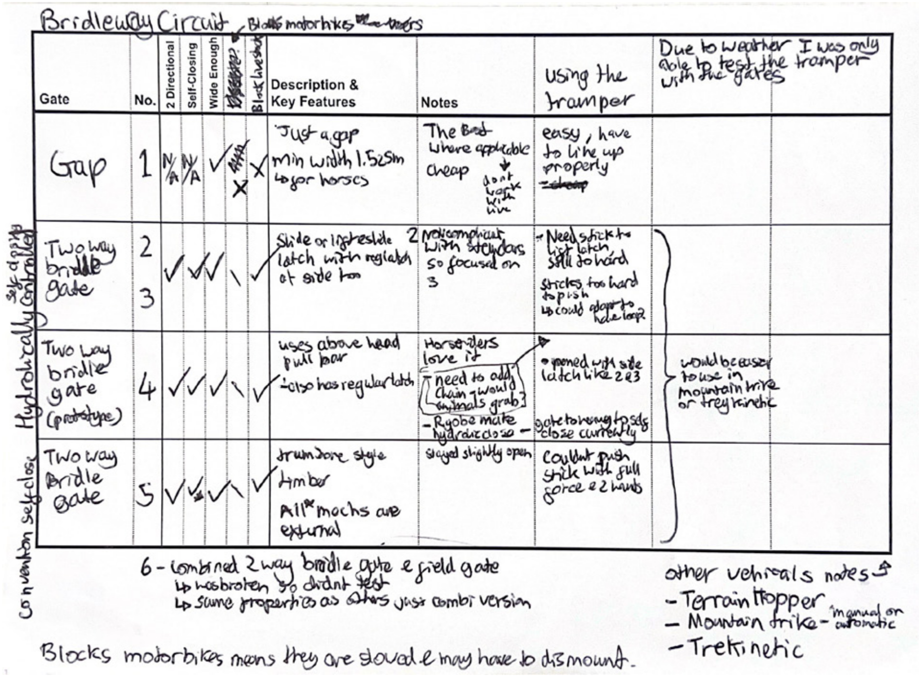
only just

18 **MOTORBIKE INHIBITOR**
Deters motorbikes, but allows all other authorised users, including mobility vehicles users.

Cnt tst

19 **VEHICLE BARRIER**
Can be used instead of a gate where additional security is required. A bridle gate or pedestrian gate will be needed alongside on a right of way or permissive path. The barrier is designed to use the hanging post as the hinge, which limits damage by vandals.

20 **FIELD GATE WITH INTEGRAL PEDESTRIAN GATE**
Used where width is limited and the field gate needs to remain locked. The integral step-through pedestrian gate is self-closing but is not accessible by all users.



Bridleway Circuit ← Blocks motorbikes ~~[illegible]~~

Hydraulically controlled self closing

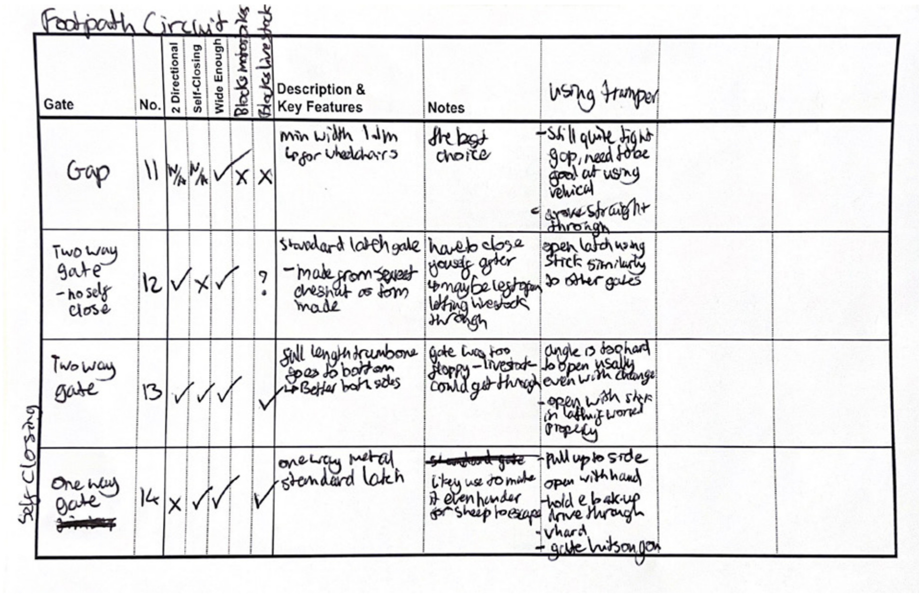
Conventional self close

Gate	No.	2 Directional	Self-Closing	Wide Enough	~~[illegible]~~	Block livestock	Description & Key Features	Notes	Using the tramper	Due to weather I was only able to test the tramper with the gates	
Gap	1	N/A	N/A	✓	~~✓~~ ✗	✗	Just a gap min width 1.525m ↳ for horses	The ~~Best~~ where applicable cheap → dont work with live	easy, have to line up properly ~~cheap~~		
Two way bridle gate	2 3	✓	✓	✓	\	✓	Slide or lift side latch with reg latch at side too	2 not compliant with standards so focused on 3	- Need stick to lift latch still too hard sticks, too hard to push ↳ could adapt to have loop?		
Two way bridle gate (prototype)	4	✓	✓	✓	\	✓	uses above head pull bar - also has regular latch	Horseriders love it - need to add chain - would animals grab? - Ryobe mate hydraulic close -	• opened with side latch like 2 & 3 gate too heavy to self close currently	would be easier to use in mountain trike or trey kinetic	
Two way Bridle Gate	5	✓	✓*	✓	\	✓	trumbone style timber All* mechs are external	stayed slightly open	Couldn't push stick with full force & 2 hands		

6 - combined 2 way bridle gate & field gate
↳ was broken so didnt test
↳ same properties as others just combi version

other vehicals notes ↱
- Terrain Hopper
- Mountain trike - manual or automatic
- Trekinetic

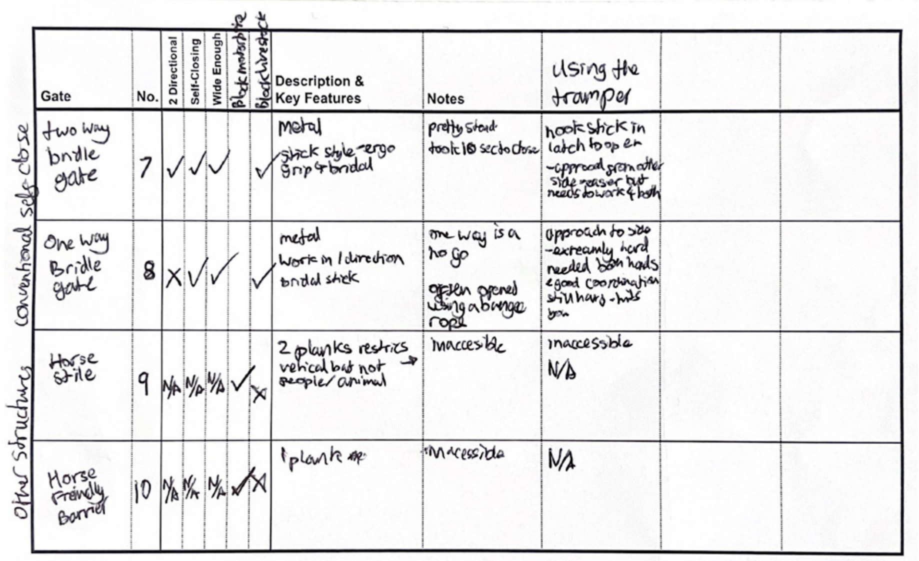
Blocks motorbikes means they are slowed & may have to dismount.



Footpath Circuit

Self closing

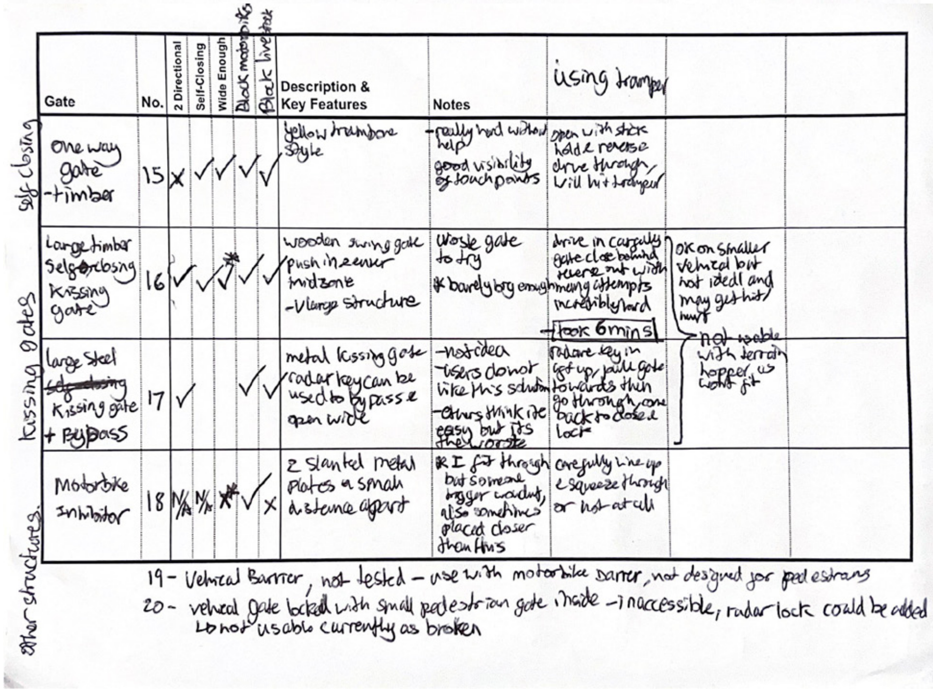
Gate	No.	2 Directional	Self-Closing	Wide Enough	Blocks motorbikes	Blocks livestock	Description & Key Features	Notes	using tramper		
Gap	11	N/A	N/A	✓	✗	✗	min width 1.1m ↳ for wheelchairs	the best choice	- Still quite tight gap, need to be good at using vehical - drove straight through		
Two way gate - no self close	12	✓	✗	✓		?	standard latch gate - made from sweet chestnut as farm made	have to close yourself after ↳ may be left open letting livestock through	open latch using stick similarly to other gates		
Two way gate	13	✓	✓	✓		✓	full length trombone goes to bottom ↳ Better both sides	gate was too floppy - livestock could get through	angle is too hard to open usally even with change - open with stick in latch if worked properly		
One way gate ~~[illegible]~~	14	✗	✓	✓		✓	one way metal standard latch	~~standard gate~~ likely use to make it even harder for sheep to escape	- pull up to side open with hand - hold & back up drive through - v hard - gate hits on you		



Conventional self close

Other structures

Gate	No.	2 Directional	Self-Closing	Wide Enough	Block motorbike	Block livestock	Description & Key Features	Notes	Using the tramper		
two way bridle gate	7	✓	✓	✓		✓	Metal stick style - ergo grip & bridal	pretty stand. took 10 sec to close	hook stick in latch to open - approach from other side - easier but needs to work & both		
One way Bridle gate	8	✗	✓	✓		✓	metal work in 1 direction bridal stick	one way is a no go often opened using a bungee rope	approach to side - extreamly hard needed both hands & good coordination still hard - hits you		
Horse stile	9	N/A	N/A	N/A	✓	✗	2 planks restrics vehical but not people/animal →	inaccesible	inaccessible N/A		
Horse Friendly Barrier	10	N/A	N/A	N/A	✓	✗	1 plank ~~[illegible]~~	inaccessible	N/A		



self closing

kissing gates

other structures.

Gate	No.	2 Directional	Self-Closing	Wide Enough	Block motorbikes	Block livestock	Description & Key Features	Notes	using tramper		
One way gate - timber	15	✗	✓	✓	✓	✓	yellow trombone style	- really hard without help good visibility of touch points	open with stick hold & reverse drive through, will hit tramper		
Large timber Self-closing Kissing gate	16	✓	✓	✓*	✓	✓	wooden swing gate push in & enter mid zone - v large structure	Worst gate to try * barely big enough	drive in carefully gate close behind reverse out with many attempts incredibly hard - took 6mins	ok on smaller vehical but not ideal and may get hit/hurt not usable with terrain hopper as wont fit	
large steel ~~self closing~~ kissing gate + Bypass	17	✓			✓	✓	metal kissing gate radar key can be used to bypass & open wide	- not idea - users do not like this solution - others think its easy but its the worst	radar key in get up, pull gate towards then go through, come back to close & lock		
Motorbike Inhibitor	18	N/A	N/A	*	✓	✗	2 slanted metal plates a small distance apart	* I fit through but someone bigger wouldnt, also sometimes placed closer than this	carefully line up & squeeze through or not at all		

19 - Vehical Barrier, not tested - use with motorbike barrer, not designed for pedestrians

20 - vehical gate locked with small pedestrian gate inside - inaccessible, radar lock could be added
↳ not usable currently as broken

APPENDIX D: EXAMPLE QUESTIONS

Unstructured Interview Questions Draft

Example questions and follow up questions for the unstructured interviews with wheeled mobility aid users.

Could you please introduce yourself and what you do (work/hobbies)?

How would you describe yourself from these options?
Mobility Aid user, Organiser, Carer/Friend or Other

What mobility aid(s) do you use(/work with)?
Do you own it or borrow/rent it?
How do you find using this in your day-to-day life?
Likes and dislikes?
Features?

Do you/how often do you go on rambles?
Who organises them, and who (if anyone) do you go with?
What types of places do you like to go?
What do you enjoy about it?

USER JOURNEY
Could you walk me through trip out rambling while using your mobility aid? (& how you feel?)

- Preparation
- Getting to site
- Once at the site
- On the footpaths & obstacles
- Accessing facilities
- Leaving

How do you find the current gates (e.g. Kissing Gate)?
share images as prompts if needed

What are your difficulties using them?
What can help you?
What external conditions make it worse?
What would be an ideal situation for you?

Unstructured Interview Questions Draft

Could you please introduce yourself and what you do?
Name:
Other info:
Additional detail (Role/how long worked):

How would you yourself from the below options:
-Farmer
-Landowner
-Other (e.g. national trust):

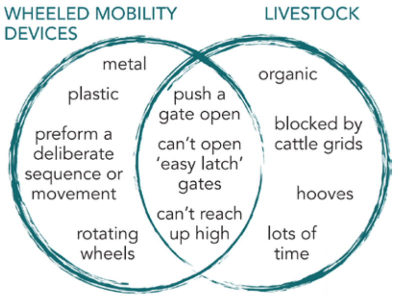
Do you work with/around animals? y/n

What are your views on the right of way?
What's your personal experience using footpaths and gates?
What is your experience of walkers, cyclists and horse riders?

What type of livestock/animals do you have/work within your fields?
How do you keep them in their fields/enclosures?
What type of footpath gates do you have (e.g. Kissing Gate)?
show images to help if needed

What are the issues you have encountered with managing gates and livestock?
Which gates do you prefer and why (for animals and for yourself)?
Are there any government regulations you are aware of?
What have you seen your animals do/what do you think they are capable of in relation to escaping through gates?

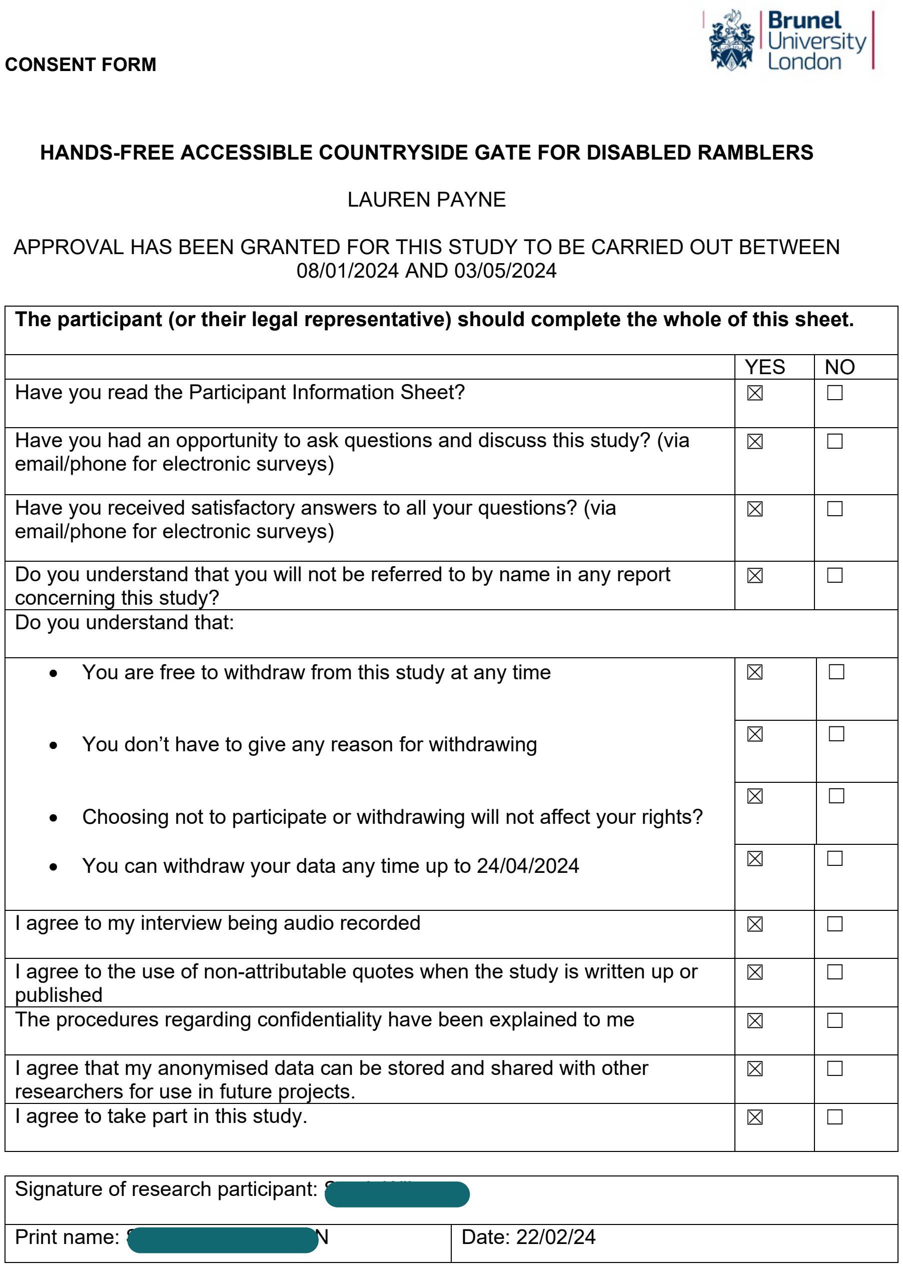
What do you think are the key differences between livestock and gates?
show Venn diagram



What do you like about current gates?
What could be improved on with current gates?
What would help you/be the ideal process of opening a gate for you?

How do you approach gate maintenance (frequency & why)?
What does it typically involve?
Would additional width around the gate work?

APPENDIX E: CONSENT FORMS



CONSENT FORM

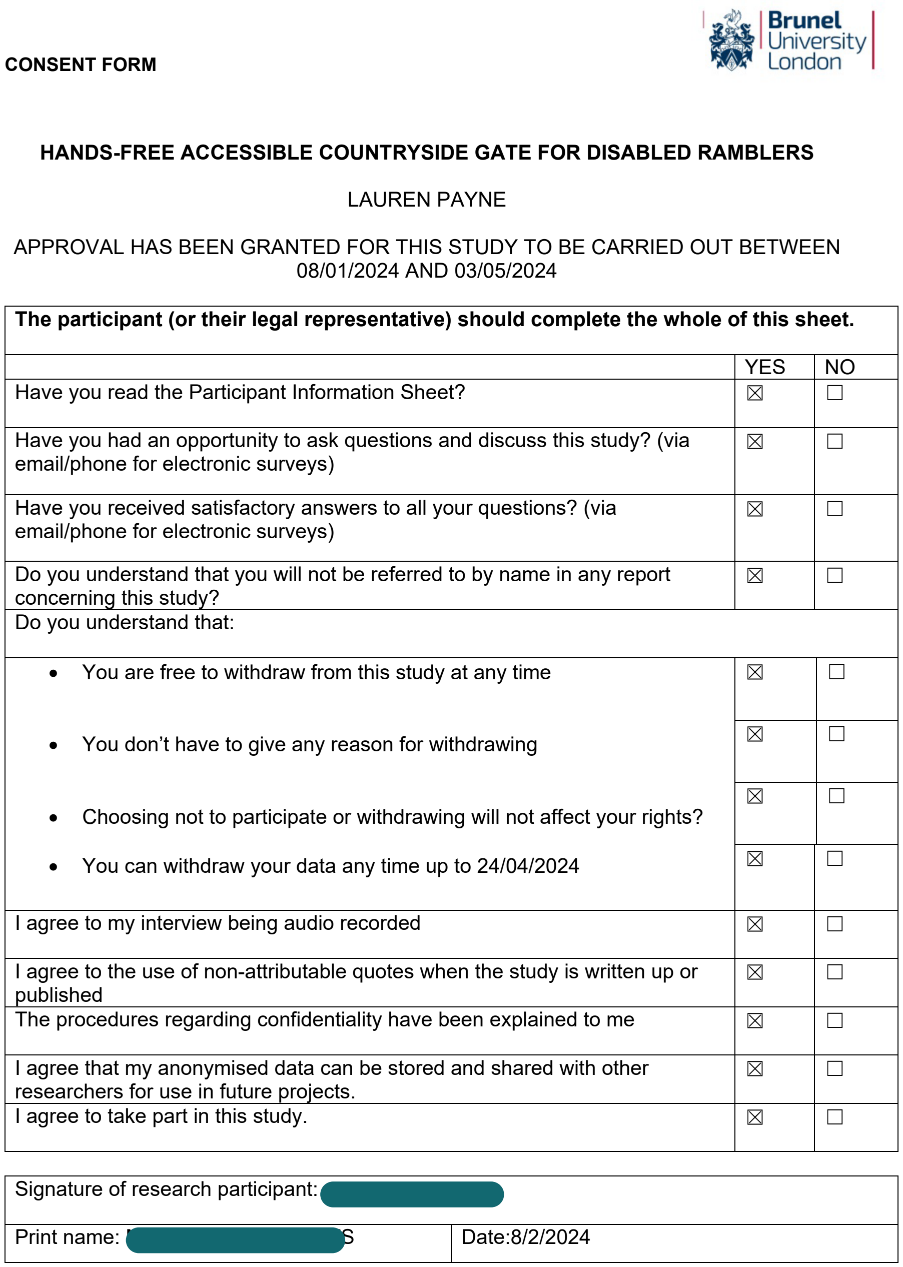
HANDS-FREE ACCESSIBLE COUNTRYSIDE GATE FOR DISABLED RAMBLERS

LAUREN PAYNE

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 08/01/2024 AND 03/05/2024

The participant (or their legal representative) should complete the whole of this sheet.		
	YES	NO
Have you read the Participant Information Sheet?	☒	☐
Have you had an opportunity to ask questions and discuss this study? (via email/phone for electronic surveys)	☒	☐
Have you received satisfactory answers to all your questions? (via email/phone for electronic surveys)	☒	☐
Do you understand that you will not be referred to by name in any report concerning this study?	☒	☐
Do you understand that:		
• You are free to withdraw from this study at any time	☒	☐
• You don’t have to give any reason for withdrawing	☒	☐
• Choosing not to participate or withdrawing will not affect your rights?	☒	☐
• You can withdraw your data any time up to 24/04/2024	☒	☐
I agree to my interview being audio recorded	☒	☐
I agree to the use of non-attributable quotes when the study is written up or published	☒	☐
The procedures regarding confidentiality have been explained to me	☒	☐
I agree that my anonymised data can be stored and shared with other researchers for use in future projects.	☒	☐
I agree to take part in this study.	☒	☐

Signature of research participant: [redacted]	
Print name: [redacted]	Date: 22/02/24



CONSENT FORM

HANDS-FREE ACCESSIBLE COUNTRYSIDE GATE FOR DISABLED RAMBLERS

LAUREN PAYNE

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 08/01/2024 AND 03/05/2024

The participant (or their legal representative) should complete the whole of this sheet.		
	YES	NO
Have you read the Participant Information Sheet?	☒	☐
Have you had an opportunity to ask questions and discuss this study? (via email/phone for electronic surveys)	☒	☐
Have you received satisfactory answers to all your questions? (via email/phone for electronic surveys)	☒	☐
Do you understand that you will not be referred to by name in any report concerning this study?	☒	☐
Do you understand that:		
• You are free to withdraw from this study at any time	☒	☐
• You don’t have to give any reason for withdrawing	☒	☐
• Choosing not to participate or withdrawing will not affect your rights?	☒	☐
• You can withdraw your data any time up to 24/04/2024	☒	☐
I agree to my interview being audio recorded	☒	☐
I agree to the use of non-attributable quotes when the study is written up or published	☒	☐
The procedures regarding confidentiality have been explained to me	☒	☐
I agree that my anonymised data can be stored and shared with other researchers for use in future projects.	☒	☐
I agree to take part in this study.	☒	☐

Signature of research participant: [redacted]	
Print name: [redacted]	Date:8/2/2024

CONSENT FORM

HANDS-FREE ACCESSIBLE COUNTRYSIDE GATE FOR DISABLED RAMBLERS

LAUREN PAYNE

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 08/01/2024 AND 03/05/2024

The participant (or their legal representative) should complete the whole of this sheet.

	YES	NO
Have you read the Participant Information Sheet?	☒	☐
Have you had an opportunity to ask questions and discuss this study? (via email/phone for electronic surveys)	☐	☒
Have you received satisfactory answers to all your questions? (via email/phone for electronic surveys)	☒	☐
Do you understand that you will not be referred to by name in any report concerning this study?	☒	☐
Do you understand that:		
• You are free to withdraw from this study at any time	☒	☐
• You don't have to give any reason for withdrawing	☒	☐
• Choosing not to participate or withdrawing will not affect your rights?	☒	☐
• You can withdraw your data any time up to 24/04/2024	☒	☐
I agree to my interview being audio recorded	☒	☐
I agree to the use of non-attributable quotes when the study is written up or published	☒	☐
The procedures regarding confidentiality have been explained to me	☒	☐
I agree that my anonymised data can be stored and shared with other researchers for use in future projects.	☒	☐
I agree to take part in this study.	☒	☐

Signature of research participant: [redacted]

Print name: [redacted]

Date: 21st February 2024

CONSENT FORM

HANDS-FREE ACCESSIBLE COUNTRYSIDE GATE FOR DISABLED RAMBLERS

LAUREN PAYNE

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 08/01/2024 AND 03/05/2024

The participant (or their legal representative) should complete the whole of this sheet.

	YES	NO
Have you read the Participant Information Sheet?	☒	☐
Have you had an opportunity to ask questions and discuss this study? (via email/phone for electronic surveys)	☒	☐
Have you received satisfactory answers to all your questions? (via email/phone for electronic surveys)	☒	☐
Do you understand that you will not be referred to by name in any report concerning this study?	☒	☐
Do you understand that:		
• You are free to withdraw from this study at any time	☒	☐
• You don't have to give any reason for withdrawing	☒	☐
• Choosing not to participate or withdrawing will not affect your rights?	☒	☐
• You can withdraw your data any time up to 24/04/2024	☒	☐
I agree to my interview being audio recorded	☒	☐
I agree to the use of non-attributable quotes when the study is written up or published	☒	☐
The procedures regarding confidentiality have been explained to me	☒	☐
I agree that my anonymised data can be stored and shared with other researchers for use in future projects.	☒	☐
I agree to take part in this study.	☒	☐

Signature of research participant:

Print name: [redacted]

Date: 22 Feb 2024

CONSENT FORM

Gordon Guest

HANDS-FREE ACCESSIBLE COUNTRYSIDE GATE FOR DISABLED RAMBLERS

LAUREN PAYNE

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 08/01/2024 AND 03/05/2024

The participant (or their legal representative) should complete the whole of this sheet.

	YES	NO
Have you read the Participant Information Sheet?	☒	☐
2. Have you had an opportunity to ask questions and discuss this study? (via email/phone for electronic surveys)	☒	☐
3. Have you received satisfactory answers to all your questions? (via email/phone for electronic surveys)	☒	☐
Do you understand that you will not be referred to by name in any report concerning this study?	☒	☐
Do you understand that:		
• You are free to withdraw from this study at any time	☒	☐
• You don't have to give any reason for withdrawing	☒	☐
• Choosing not to participate or withdrawing will not affect your rights?	☒	☐
• You can withdraw your data any time up to 24/04/2024	☒	☐
I agree to my interview being audio recorded	☒	☐
I agree to the use of non-attributable quotes when the study is written up or published	☒	☐
The procedures regarding confidentiality have been explained to me	☒	☐
I agree that my anonymised data can be stored and shared with other researchers for use in future projects.	☒	☐
I agree to take part in this study.	☒	☐

Signature of research participant: [redacted]	
Print name: [redacted]	Date:05/03/2023

Question 2 and 3 above I can't answer as Lauren will explain in the interview.

[redacted]

CONSENT FORM

HANDS-FREE ACCESSIBLE COUNTRYSIDE GATE FOR DISABLED RAMBLERS

LAUREN PAYNE

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 08/01/2024 AND 03/05/2024

The participant (or their legal representative) should complete the whole of this sheet.

	YES	NO
Have you read the Participant Information Sheet?	☒	☐
Have you had an opportunity to ask questions and discuss this study? (via email/phone for electronic surveys)	☒	☐
Have you received satisfactory answers to all your questions? (via email/phone for electronic surveys)	☒	☐
Do you understand that you will not be referred to by name in any report concerning this study?	☒	☐
Do you understand that:		
• You are free to withdraw from this study at any time	☒	☐
• You don't have to give any reason for withdrawing	☒	☐
• Choosing not to participate or withdrawing will not affect your rights?	☒	☐
• You can withdraw your data any time up to 24/04/2024	☒	☐
I agree to my interview being audio recorded	☒	☐
I agree to the use of non-attributable quotes when the study is written up or published	☒	☐
The procedures regarding confidentiality have been explained to me	☒	☐
I agree that my anonymised data can be stored and shared with other researchers for use in future projects.	☒	☐
I agree to take part in this study.	☒	☐

Signature of research participant:	
Print name: [redacted]	Date: 5.3.24

CONSENT FORM

Brunel University London

HANDS-FREE ACCESSIBLE COUNTRYSIDE GATE FOR DISABLED RAMBLERS

LAUREN PAYNE

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 08/01/2024 AND 03/05/2024

The participant (or their legal representative) should complete the whole of this sheet.		
	YES	NO
Have you read the Participant Information Sheet?	☑	☐
Have you had an opportunity to ask questions and discuss this study? (via email/phone for electronic surveys)	☑	☐
Have you received satisfactory answers to all your questions? (via email/phone for electronic surveys)	☑	☐
Do you understand that you will not be referred to by name in any report concerning this study?	☑	☐
Do you understand that:		
• You are free to withdraw from this study at any time	☑	☐
• You don't have to give any reason for withdrawing	☑	☐
• Choosing not to participate or withdrawing will not affect your rights?	☑	☐
• You can withdraw your data any time up to 24/04/2024	☑	☐
I agree to my interview being audio recorded	☑	☐
I agree to the use of non-attributable quotes when the study is written up or published	☑	☐
The procedures regarding confidentiality have been explained to me	☑	☐
I agree that my anonymised data can be stored and shared with other researchers for use in future projects.	☑	☐
I agree to take part in this study.	☑	☐

Signature of research participant:

Print name: [redacted]

Date: 21/2/24

APPENDIX F: TRANSCRIPTS EXERTS

WHY THEY ENJOY GOING OUT AND WHAT THEY ENJOY ABOUT IT

Just exploring, you know - coming down the trail was brilliant.

It's just getting away from the roads, on trails - Participant 2

For me. Get the camera out. Take some pictures, get the binoculars out stuff and have a rest ?? in my the view.
You know, if I take the sketchbook, I might do a little bit of sketching in. I might write a poem, you know, I like to amble ramble. Rather than you know, gotta get here. Gotta get there, you know, gotta do it by a certain time. So I generally go on my own. - Participant 1

I think of, you know, from the sort of the mental health angle. I mean, it's great to get out and about, get some fresh air. You know, I work from home and I'm inside, you know, 35 hours a week at least and as the weather gets better, it would be great to get out and about more definitely.

I think my my sort of ideal is is like I said, you know to be able to take the dog out as well and for him to sort of have, you know, long walks and in different places, so that's a big motivation. But just for myself, you know, it's just great to to get out there and and explore a bit really you know. - Participant 3

Well, I like getting out, you know, and when we go out, we're out for the day. So you know it's it's not a short period of time and I I just like, I just like being out really and back end - Participant 4

WHAT THEY WANT PEOPLE TO KNOW

Well, there's always this big thing about barriers and gates there to stop motorbikes. There's the expression, 'you cannot stop legitimate users by putting barriers in place to stop illegitimate users', you've got to find another way around it. Certainly, if the objectors were in the position that some of us are in they would think differently. - Participant 2

So it isn't just disabled people as I always say good access is good access for everybody. - Participant 1

I had my spinal injury because I was 24 and I got on the back of my friend's motorbike, which can happen to anybody, you know, anybody can have a a spinal injury and you can be walking around one day and the next minute you, you know, you confined to a chair, you know, so it I think that's the crux of it is, is that understanding that actually. This could be me, this could impact me at any age, you know. Participant 3

I think it's quite hard because, as ever, there's conflicting needs in any place and so if you let a wheelchair user you perhaps let a motocross bike through, and then there's a small minority of people who don't kind of abide by countryside code or whatever....you know the it's the conflicting things. You have livestock, you have people, you have privacy, you have horses, bikes, quads, motocross. - Participant 5

APPENDIX G: INITIAL PDS

PERFORMANCE

- The product must be independently openable by wheeled mobility aid users without the need for standing, fine motor skills or significant force exertion.
- The product must restrict livestock
- The product must be usable by other pedestrians and horse riders
- The product must operate and open in both directions
- The product must self close
- The product should stay open long enough for the wheeled mobility aid user to get through
- The product should work with a range of mobility devices
- The product could work without the need for additional tech (e.g.. electronic sensors)
- The product could use pressure plates

ERGONOMICS

- The product must be operational without the use of both hands
- The product must be human scale
- The product must be a minimum of 1.1m wide to accommodate wheeled mobility aid users
- The product should be intuitive to use without additional training

AESTHETICS

- The product must have clear touchpoints and may use colour to improve accessibility
- The product aesthetics should align with existing countryside gates

MATERIALS

- The product must be primarily made of timber and/or steel
- The product must be durable
- The product must not use materials or substances that could leach into the environment

ENVIRONMENT OF USE

- The product must be weatherproof and suitable for permanent outdoor exposure
- The product must not disrupt the aesthetics of the countryside environment
- The product must be compatible with existing fences

SERVICE LIFE

- The product should last a minimum of 10 years (current gate minimum lifespans 10-25)
- If using electronics, the product should last a minimum of 5 years.

MAINTENANCE

- The product should require minimal maintenance within its service life
- The product should be deconstructable to allow for replacement of individual parts

MANUFACTURING

- The product should be suitable for batch production
- The product will be produced in the UK to reduce travel emissions
- The product should aim to use minimal additional tech to keep manufacturing cost down
- The product should use standard components and current manufacturing techniques where possible to reduce additional costs
- The final manufacturing cost should not exceed 3x the cost to produce other gates

MARKET

- The product is designed for wheeled mobility aid users in the UK
- The product would suitable to be pitched to Centrewire for manufacture
- The product would be distributed to Natural England and to other Landowners and Land Stewards
- The product could cost no more that 4x higher end gates

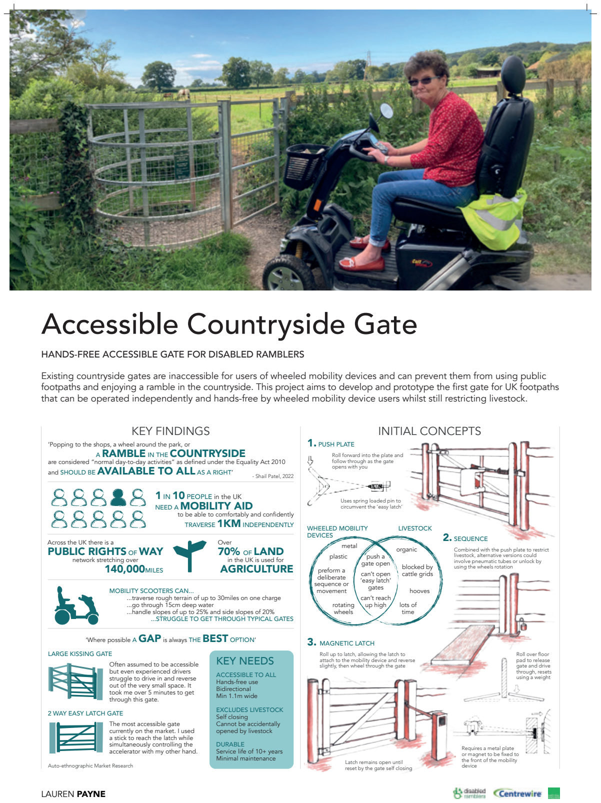
QUALITY AND RELIABILITY

- The product should consistently work every time
- The product should be able to withstand abuse from the environment, animals and people
- The tolerances should allow for the compression and expansion of metal and wood throughout the seasons
- Any electronics must be isolated to avoid damage

STANDARDS & LEGAL REQUIREMENTS

- The product must meet UK legal requirements in relation to gates

APPENDIX H: IRE BOARD


Accessible Countryside Gate

HANDS-FREE ACCESSIBLE GATE FOR DISABLED RAMBLERS

Existing countryside gates are inaccessible for users of wheeled mobility devices and can prevent them from using public footpaths and enjoying a ramble in the countryside. This project aims to develop and prototype the first gate for UK footpaths that can be operated independently and hands-free by wheeled mobility device users whilst still restricting livestock.

LAUREN **PAYNE**

Accessible Countryside Gate

HANDS-FREE ACCESSIBLE GATE FOR DISABLED RAMBLERS

Existing countryside gates are inaccessible for users of wheeled mobility devices and can prevent them from using public footpaths and enjoying a ramble in the countryside. This project aims to develop and prototype the first gate for UK footpaths that can be operated independently and hands-free by wheeled mobility device users whilst still restricting livestock.

KEY FINDINGS

'Popping to the shops, a wheel around the park, or A **RAMBLE** IN THE **COUNTRYSIDE** are considered "normal day-to-day activities" as defined under the Equality Act 2010 and SHOULD BE **AVAILABLE TO ALL** AS A RIGHT'

- Shail Patel, 2022

1 IN **10** PEOPLE in the UK NEED A **MOBILITY AID** to be able to comfortably and confidently TRAVERSE **1KM** INDEPENDENTLY

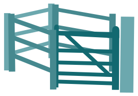
Across the UK there is a **PUBLIC RIGHTS** OF **WAY** network stretching over **140,000**MILES

Over **70%** OF **LAND** in the UK is used for **AGRICULTURE**

MOBILITY SCOOTERS CAN...
...traverse rough terrain of up to 30miles on one charge
...go through 15cm deep water
...handle slopes of up to 25% and side slopes of 20%
...STRUGGLE TO GET THROUGH TYPICAL GATES

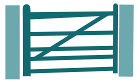
'Where possible A **GAP** is always THE **BEST** OPTION'

LARGE KISSING GATE



Often assumed to be accessible but even experienced drivers struggle to drive in and reverse out of the very small space. It took me over 5 minutes to get through this gate.

2 WAY EASY LATCH GATE



The most accessible gate currently on the market. I used a stick to reach the latch while simultaneously controlling the accelerator with my other hand.

Auto-ethnographic Market Research

KEY NEEDS

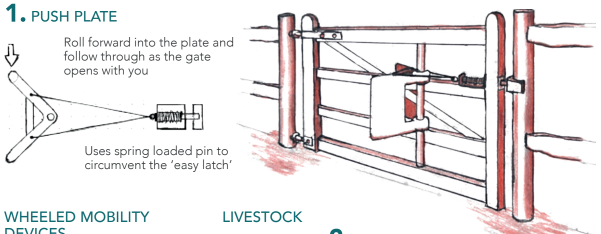
ACCESSIBLE TO ALL
Hands-free use
Bidirectional
Min 1.1m wide

EXCLUDES LIVESTOCK
Self closing
Cannot be accidentally opened by livestock

DURABLE
Service life of 10+ years
Minimal maintenance

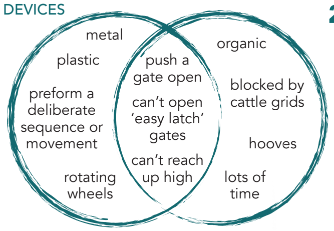
INITIAL CONCEPTS

1. PUSH PLATE



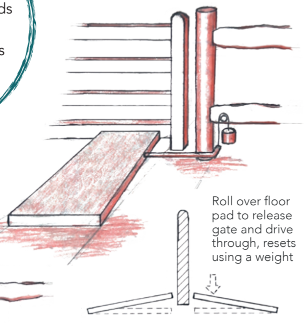
Roll forward into the plate and follow through as the gate opens with you

Uses spring loaded pin to circumvent the 'easy latch'



2. SEQUENCE

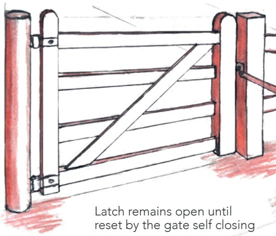
Combined with the push plate to restrict livestock, alternative versions could involve pneumatic tubes or unlock by using the wheels rotation



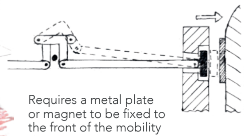
Roll over floor pad to release gate and drive through, resets using a weight

3. MAGNETIC LATCH

Roll up to latch, allowing the latch to attach to the mobility device and reverse slightly, then wheel through the gate



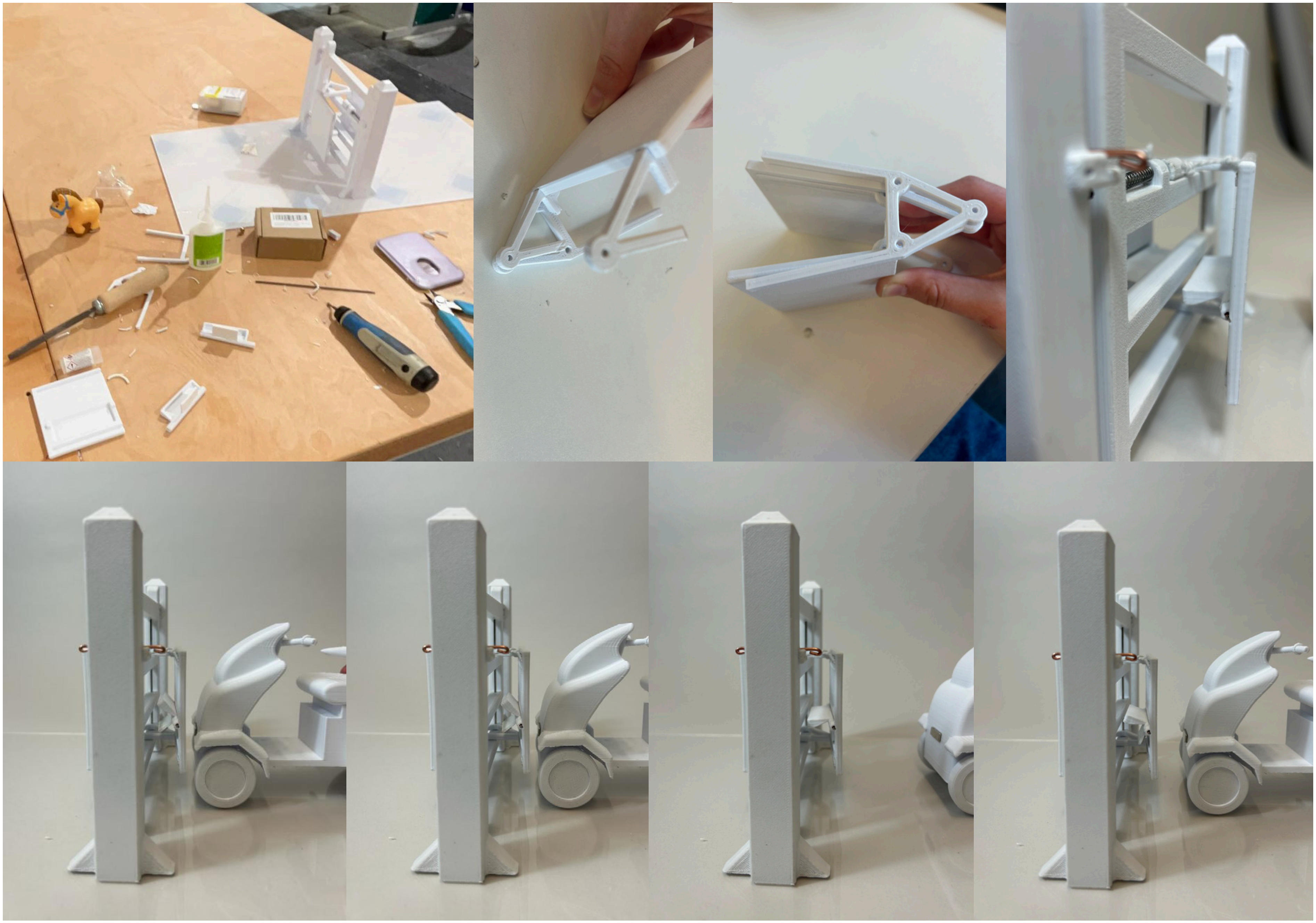
Latch remains open until reset by the gate self closing

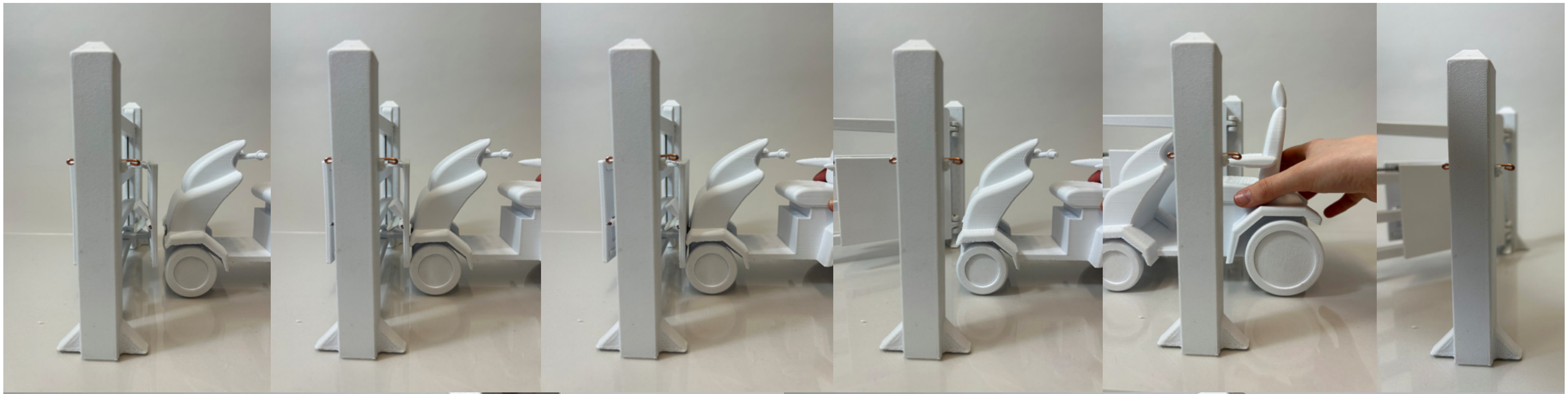


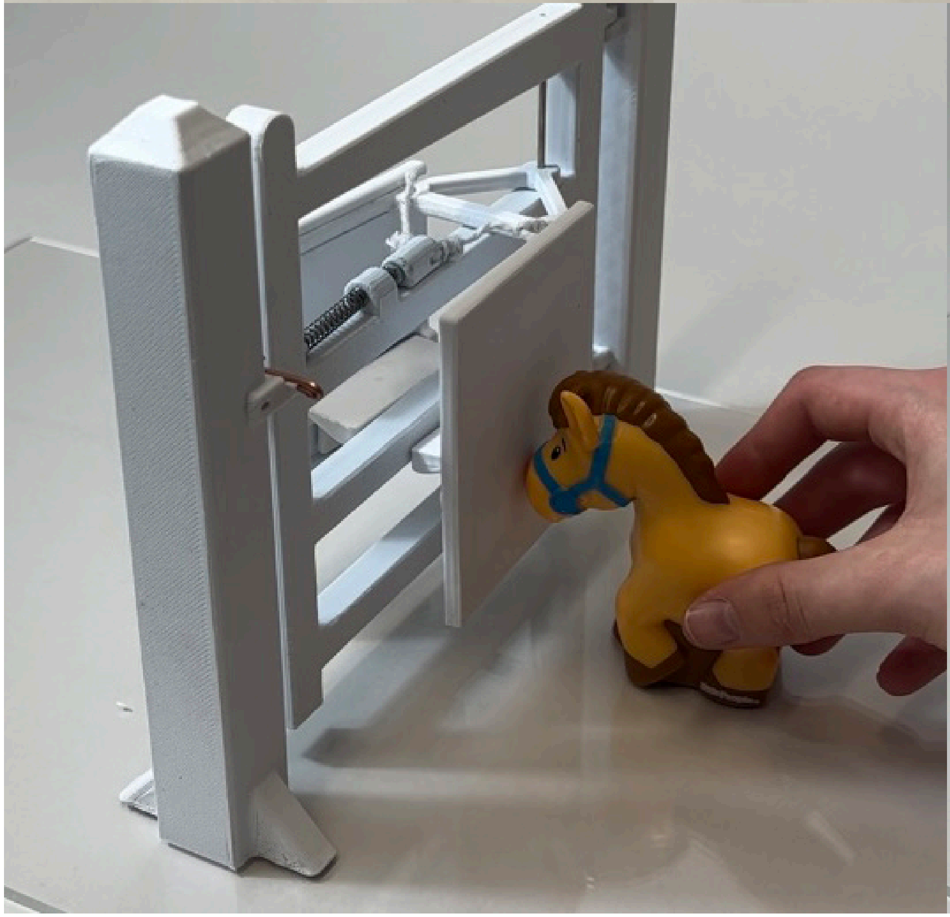
Requires a metal plate or magnet to be fixed to the front of the mobility device

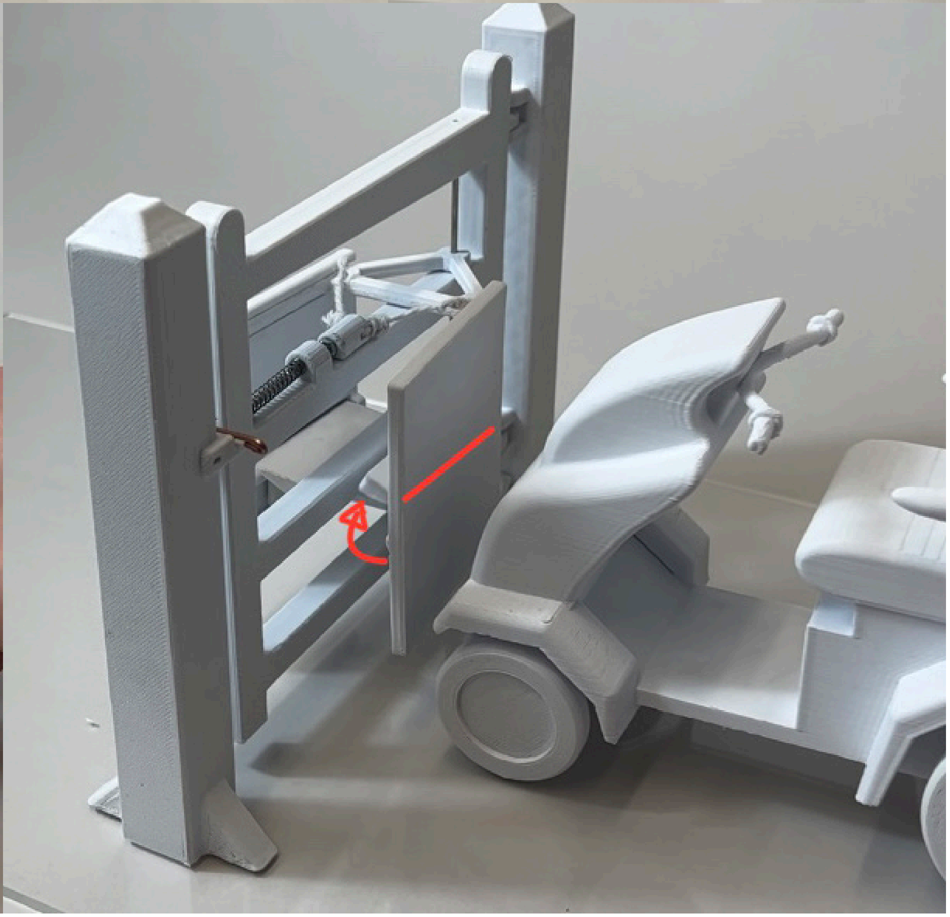
LAUREN **PAYNE**

APPENDIX I: MODELS

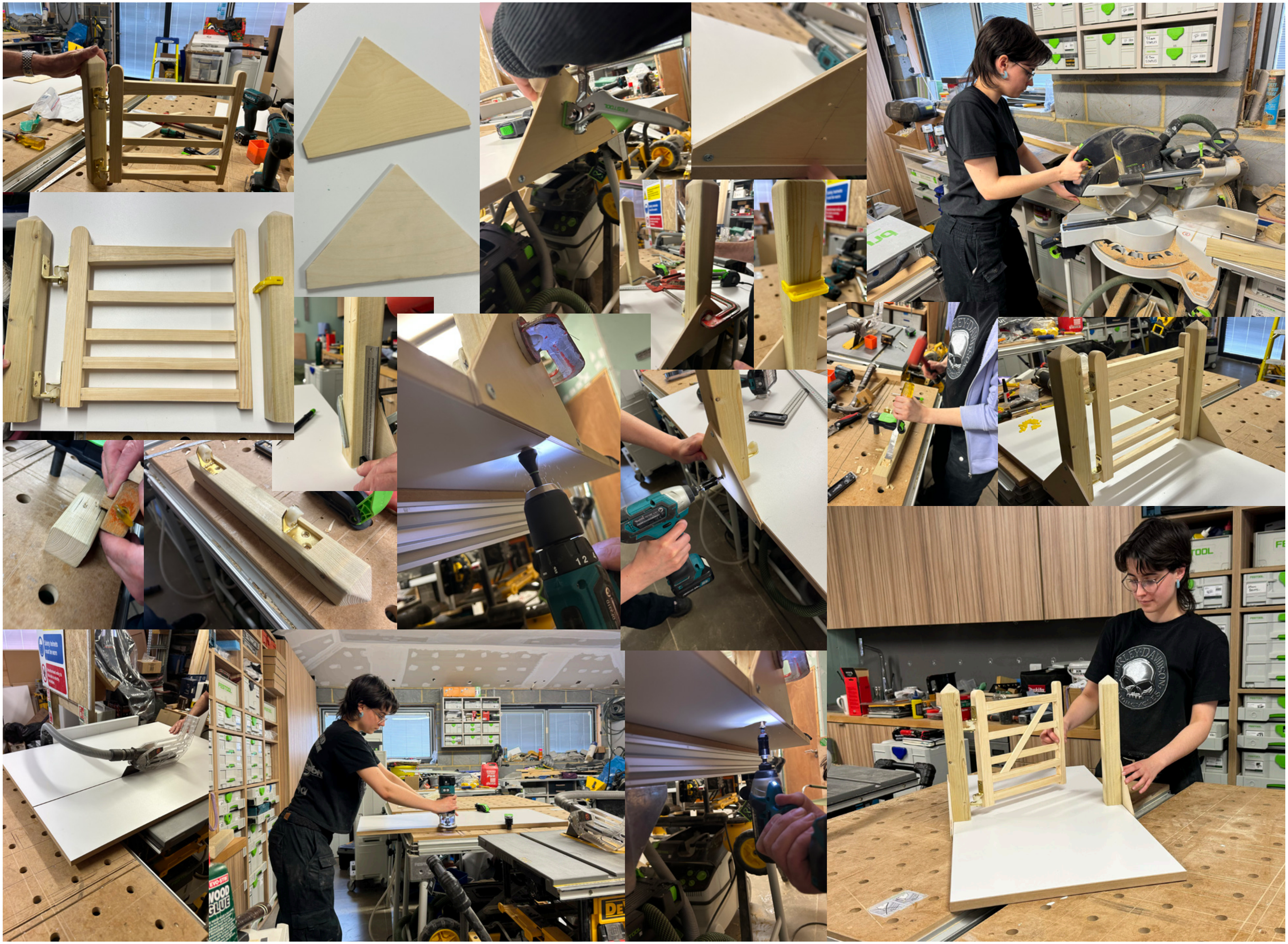


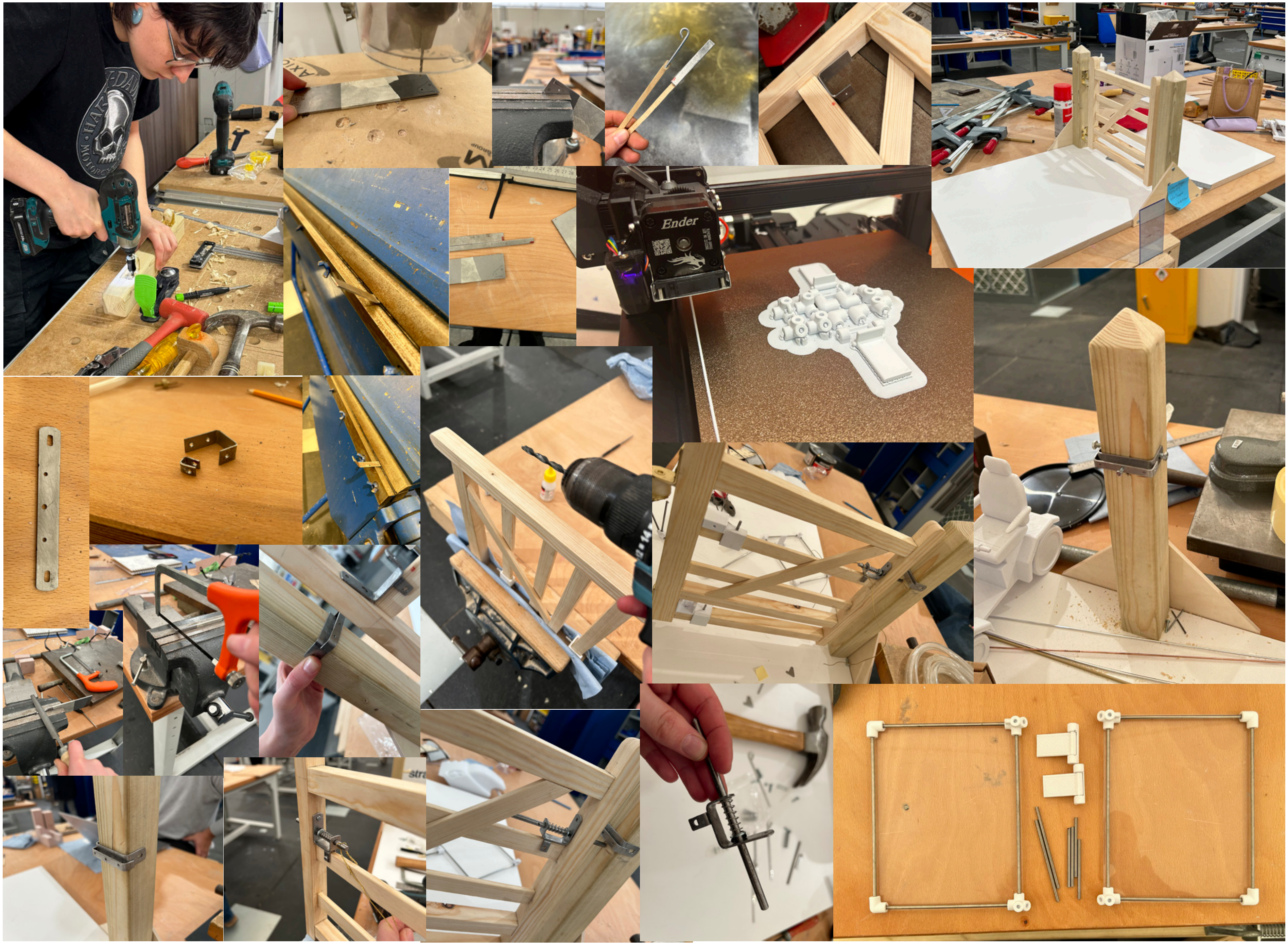




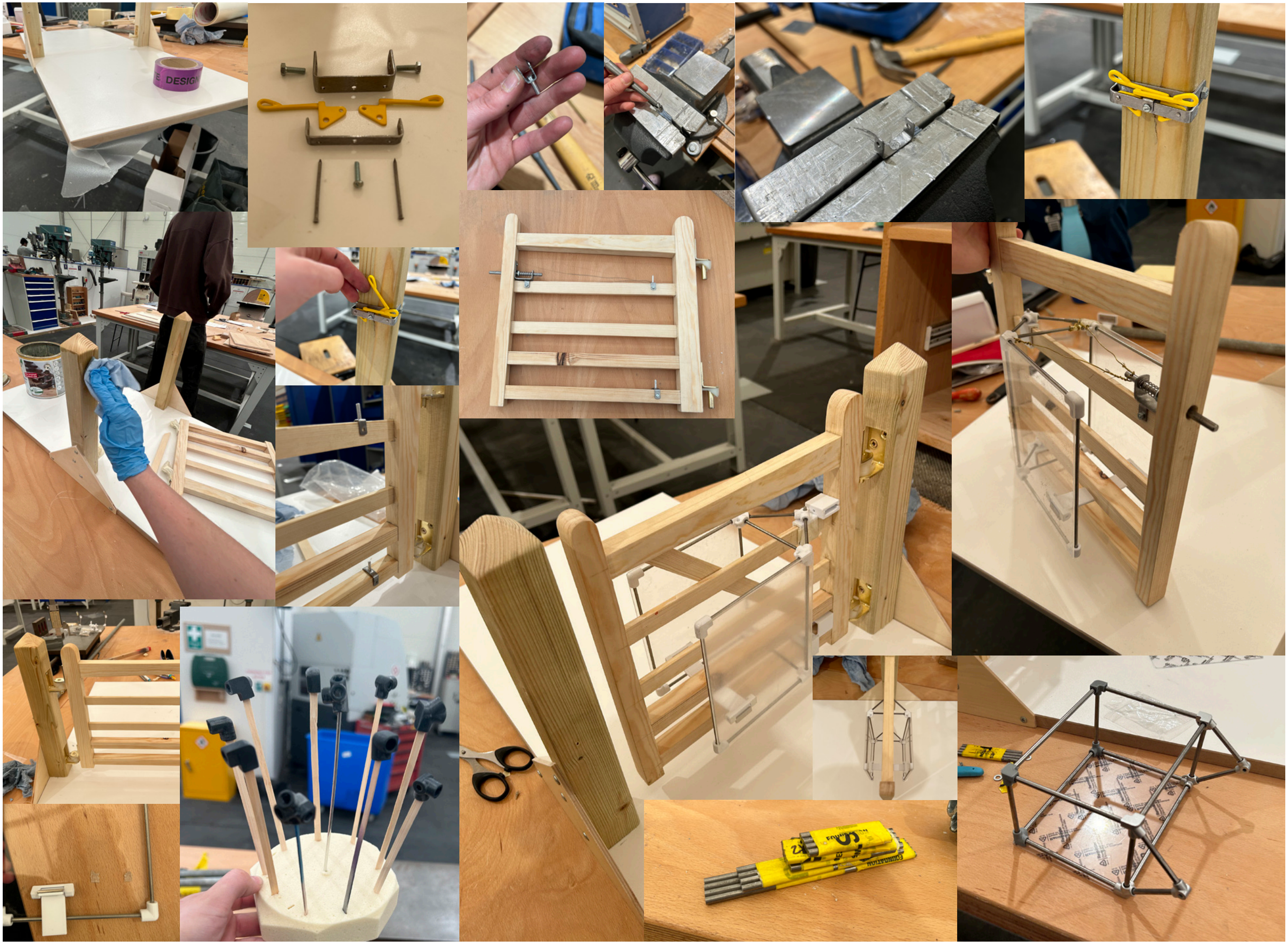


APPENDIX J: 1:4 SCALE MODEL

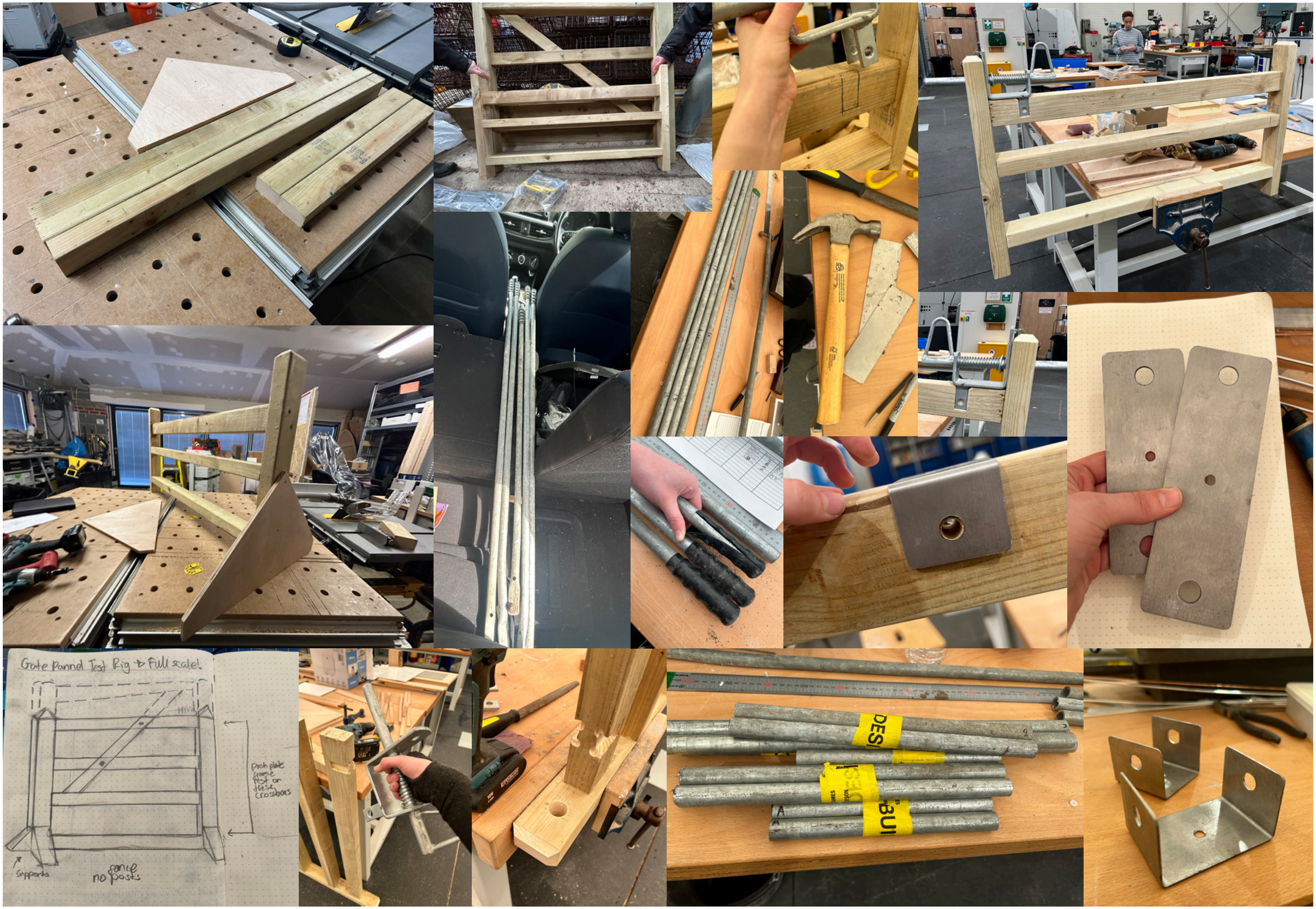




Ender

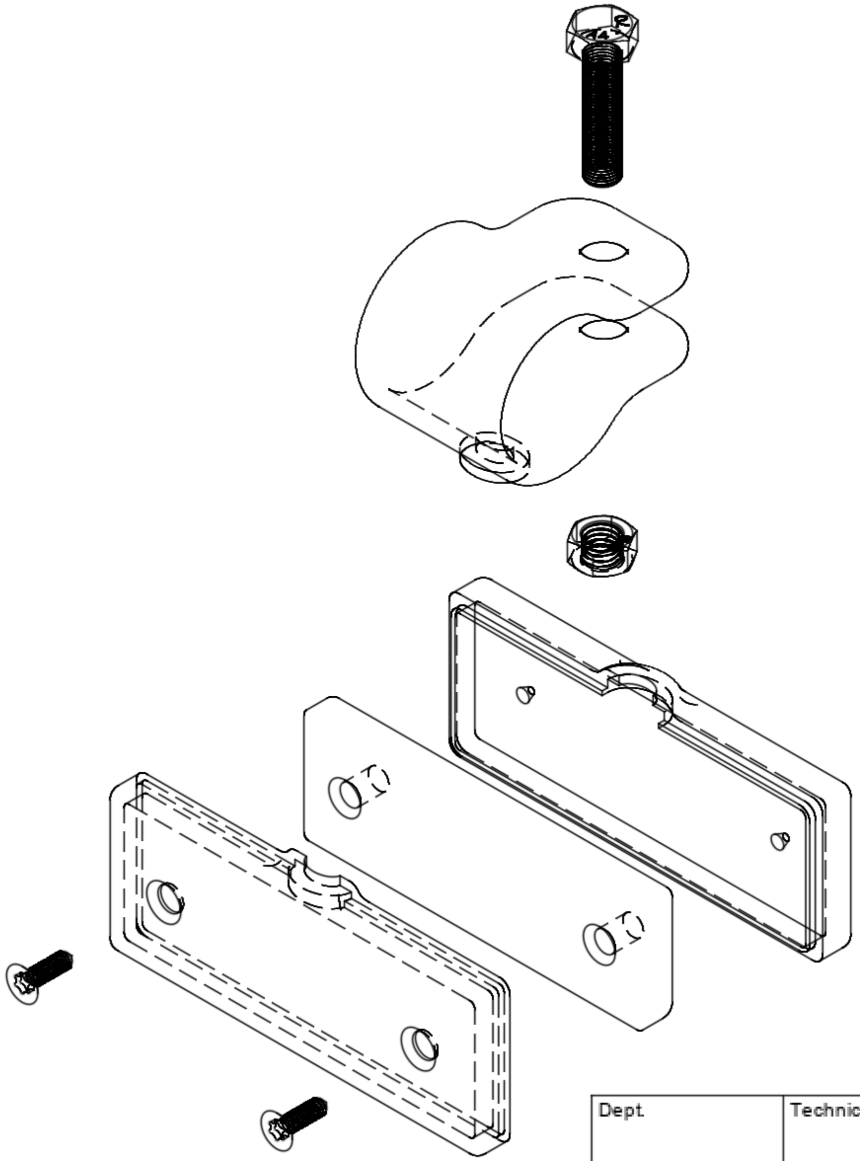

DESIGN

APPENDIX K: SECTIONAL MODEL

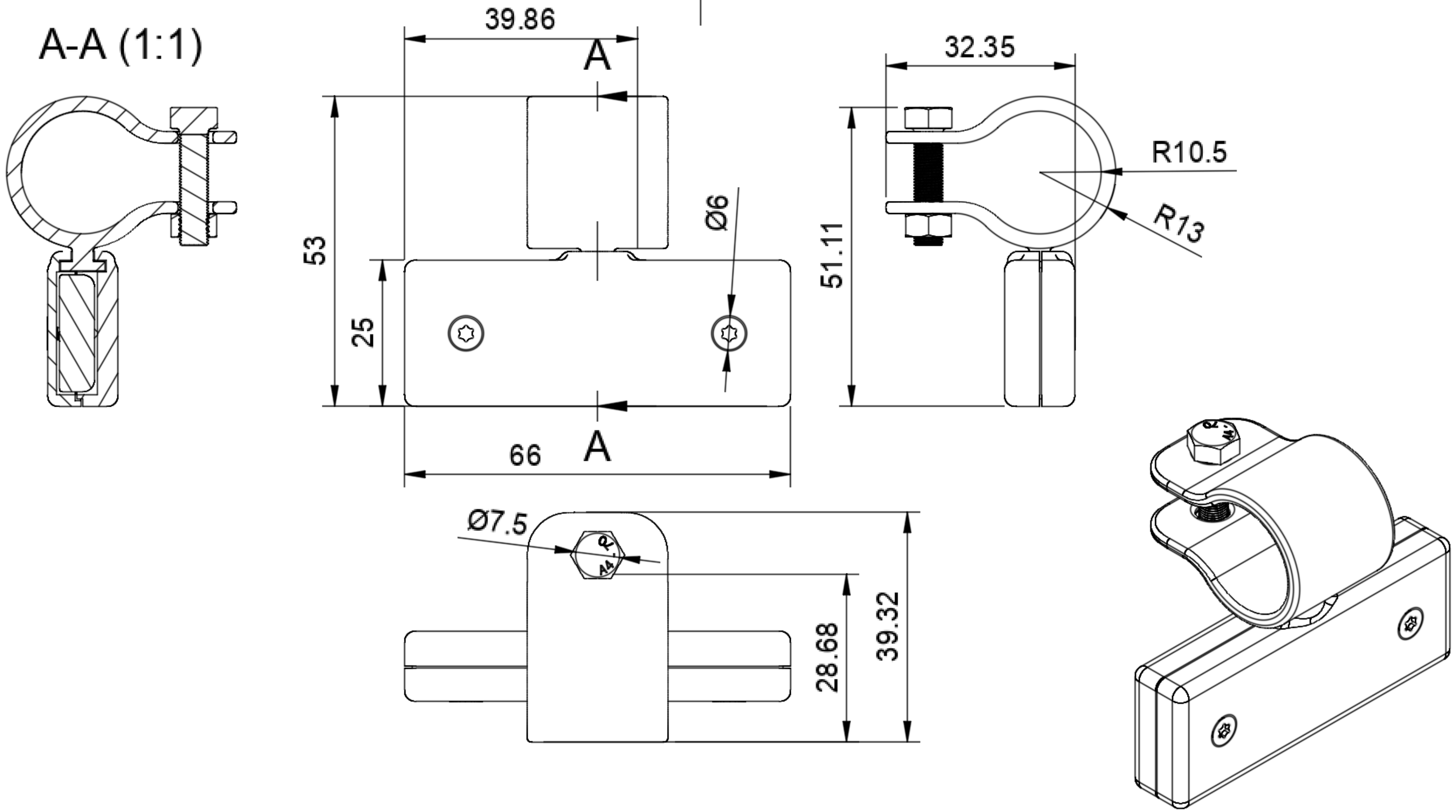

Gate Pannel Test Rig → Full scale!
Push plate frame test on these crossbars
Supports
no fence posts

CREALITY
TREASURER
1
2
3

APPENDIX L: TECHNICAL DRAWINGS



Dept.	Technical reference	Created by Lauren Payne 14/05/2024	Approved by
		Document type	Document status
		Title Magpass Exploded view	DWG No.
			Rev.
			Date of issue
			Sheet 1/1



Dept.	Technical reference	Created by Lauren Payne 14/05/2024	Approved by
		Document type	Document status
		Title Magpass	DWG No.
			Rev. / Date of issue / Sheet 1/1